ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 16, No. 19. WEEKLY.

NEW YORK, SATURDAY, JULY 5, 1890.

$3 per annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

A Lamp Hour Recorder.

The rapid strides which central station lighting for large areas has made of late years, have brought incandescent lamps into many places distant from the stations. The more so, since the competition between the direct and alternating current systems of distribution has tended to stretch out the area supplied by each station. In this way many places which had not installed an isolated plant have received the luxury of incandescent lamps. The usual basis of charges for the current supplied has been the number of lamp hours at the consumer's place, *i. e.*, the number of lamps multiplied by the number of hours which they were burning. In many places, especially in large business houses where the lights are manipulated by gang switches, the lamps controlled by each switch are all turned on or off together. Then it is only necessary to keep count of the number of hours they were burning, in order to compute the charges. The need of a simple and reliable counter for use with incandescent lights has long been felt. This want is met by Pattee's electric lamp hour recorder, an instrument now being brought out by the Great Western Electric Supply Company, Chicago. The cut shows it with the door to the enclosing case opened. A clock-work with two powerful springs intended to run the recorder 720 hours, has three dials registering the hours, tens and hundreds.

The inverted horseshoe magnet, mounted on a brass plate below the clock, has its coils connected in series with the German silver resistance shown right beside it, the whole being connected in shunt with the lamps. The armature of the lamps is hung from a slender rod, and by its weight acts through a bell crank lever as a brake to the escapement wheel of the clock. When the current to the lamp is turned on, the armature is drawn up, and, acting on the lever and brake at once, rel ases and starts the escapement. As soon as the current is stopped, whether by the switch near by or by the shutting down of the station, the armature falls and stops the clock. Thus, the clock only runs when the lamps are burning, and the dial readings give the number of hours directly.

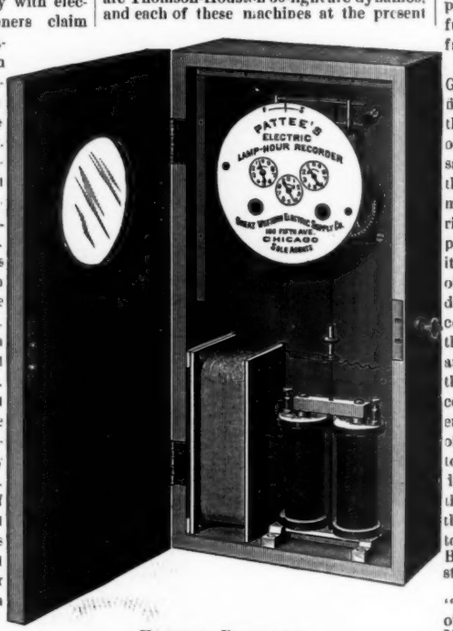
The whole apparatus is well built, and seems to have nothing about it which could get out of order. The German silver wire is wound on a bobbin with perforated heads, and has air spaces between the layers. The turn buckle, shown in the middle of the rod to which the armature is fastened, serves to adjust the play of the armature and its distance from the magnet poles. The lever, slide and brake are very neatly arranged, giving a positive start to the escapement and stopping it instantaneously.

The recorder is mounted on a walnut case like a clock, the dial being visible through a glass plate. A lock assures the current supplier that the instrument is not being tampered with, while the direct reading dial should give the consumer confidence in the correctness of the readings.

As ordinarily built, the coils have such a resistance that on a 110-volt circuit the energy consumed is only 10 watts. By suitably varying the resistance, the Pattee recorder can be adopted to currents of any pressure. Moreover, it can be adopted for use with multiple, series, series-multiple or multiple-series lines and also alternating currents.

May Put Out the Light.

A suit which may result in plunging the city in darkness, says the Baltimore *Sun*, was filed in the United States Circuit Court by Hon. H. D. Seymour, representing the Brush Electric Company. The suit is against the Municipal Electric Light and Power Company, which has the contract to light the streets of the city with electric arc lights. The petitioners claim Charles Brush obtained the patent right to the double carbon arc lamps, and since then has secured all the rights on the automatic switch and other appliances which go to make up the lamps. The petition contains the proceedings of a similar suit against the Sperry Electric and Belvedere Electric Company, of Chicago, in which Judge W. Q. Gresham, of the United States Circuit Court of the Northern District of Illinois, granted the Brush Company an injunction. Should an injunction, even a temporary one, be granted, it will shut off the light for a time, and if made perpetual, the light will be shut off entirely, or the Municipal company will be compelled to pay a handsome royalty for the right to use the lamps. There is as much possibility of Judge Thayer refusing to grant an injunction. If the defendants are made to pay a royalty, it will knock a big lump off their profits, as the contract was a close shave one at first.



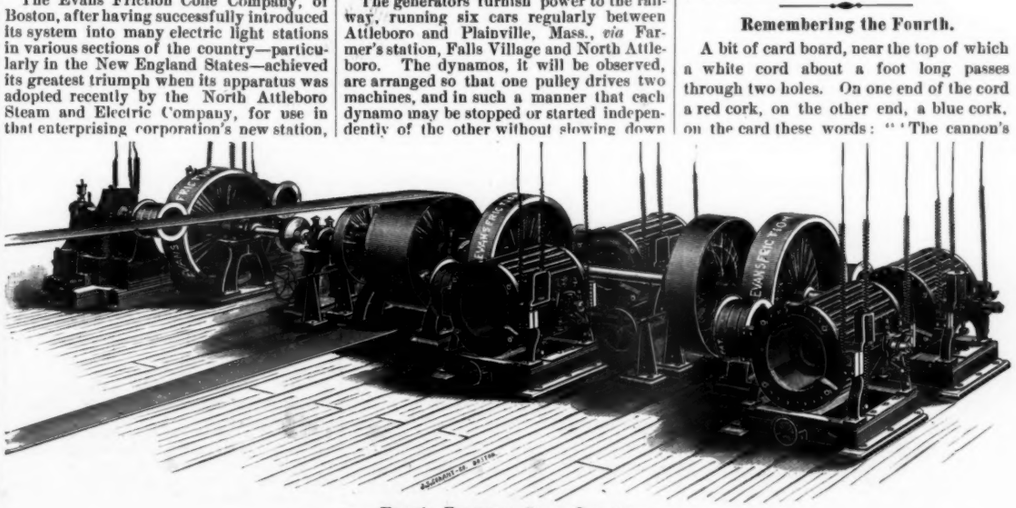
ELECTRIC RECORDER.

The Evans System at the North Attleboro Steam and Electric Company's Station.

The Evans Friction Cone Company, of Boston, after having successfully introduced its system into many electric light stations in various sections of the country—particularly in the New England States—achieved its greatest triumph when its apparatus was adopted recently by the North Attleboro Steam and Electric Company, for use in that enterprising corporation's new station, at Farmer's, one mile distant from Attleboro, Mass. The new station is practically finished; in fact is already furnishing both arc and incandescent lights as well as electric power. The accompanying illustration presents a view of the dynamo room and shows the line shaft which is driven from an Ide compound condensing engine of 250 horse-power by means of a belt, and the shaft is connected directly to the dynamo machines and power generators by the Evans system. The two machines at the extreme left of the cut are each 60 horse-power Thomson-Houston railway generators, both running on the same circuit. The power on these two machines varies from almost nothing to 140 horse-power many times an hour. The four machines shown at the right of the cut are Thomson-Houston 50-light arc dynamos, and each of these machines at the present time is loaded to its full capacity. The speed of the generators is 1,150 revolutions, and the arc dynamos, 820 revolutions.

The generators furnish power to the railway, running six cars regularly between Attleboro and Plainville, Mass., *via* Farmer's station, Falls Village and North Attleboro. The dynamos, it will be observed, are arranged so that one pulley drives two machines, and in such a manner that each dynamo may be stopped or started independently of the other without slowing down the engine. By placing one pulley on two dynamos the pressure on the shaft bearing is greatly lessened.

The electric company is about to add to its station equipment another large compound engine, which will be belted direct to a continuation of the line of shafting now in position; a clutch coupling will connect the proposed continuation with the present shaft. On the new shaft will also be placed the Evans system, which will run several additional dynamos.



EVAN'S FRICTION CONE SYSTEM.

New York's Possible Shame.

So New York will probably return to illumination by gas—at least, that is what the commissioners say. Three sets of bids have been asked from the electric lighting companies; two sets have been opened and refused. The third set remains to be heard from. A fable is in order.

The Miser bought his oil of the Poor Grocer. He paid a fair price for it; but finally his miserly instincts began to make themselves felt, and he sat down to think out a way to get his oil cheaper. "Ha!" said the Miser, "I will put up a toll gate on the highway along which the Poor Grocer must pass to bring me my oil." Now, what right he had to build a toll gate on the public highway, no one knew. But he built it, nevertheless. As usual, he ordered his oil of the Poor Grocer and when he came to deliver it, the Miser was on hand, ready to collect his toll. When the Poor Grocer saw that the toll was eating up all his profits, and really making him sell his oil for less than it cost him to deliver it, he naturally complained; but the Miser, being an influential man, said, "You shall bring me my oil by the highway, and I will not allow you to take any short cuts across the fields in delivering it." The Poor Grocer, finding that he could not possibly supply the oil at the old price and pay toll besides, undertook to raise the price so as to cover the toll. But hereupon the Miser lost his temper and stormed about at a dreadful rate.

"Confound your impudence!" said he, "I will burn candles before I will buy your oil if you raise the price." But as the Miser's family have some influence with him, he is still undecided between candles and oil, with a leaning toward candles.

"The moral o' this 'ere obserwation is in the application on it."

Remembering the Fourth.

A bit of card board, near the top of which a white cord about a foot long passes through two holes. On one end of the cord a red cork, on the other end, a blue cork, on the card these words: "'The cannon's roar is hushed.' (Four stars.) At 11.55 o'clock, July 3d, insert the red cork in your right ear; allow the white string to repose quietly on your neck; place the blue cork in your left ear, and, decorated with these emblems of patriotism, enjoy a peaceful 4th of July slumber from 12 to 7 A. M., and credit the same to our account.—American Electrical Works, Providence, R. I."

It's beautiful! and we rather think it will foil the small boy and the big fire cracker, a combination to be dreaded.

A Well Lighted Steamship.

The new lake steamship "Indiana," which was recently built by the Goodrich Steamship Co., and lately launched, making its maiden trip, Monday, June 9th, and commencing its regular trips, Thursday, June 12th, is equipped throughout with incandescent lights of the Mather system.

The electric plant was installed by the Chicago office of the Mather Co., and consists of one 250-light dynamo, power for which is supplied by an Elems upright engine of 25 horse-power, rope transmission being used in driving the dynamo. The lights are nicely distributed throughout the boat, which is beautifully furnished. Plush furniture and draperies are used in the main saloon, while rich mouquet carpets adorn the floor, the woodwork being solid mahogany.

The lights are arranged similar to border lights in a theatre, while from the center of the ceiling hang four beautiful eight-light electroliers. On each of the 14 pillars supporting the roof of the main cabin are placed electroliers of special design, each holding two lights.

In the toilet rooms, smoking rooms and officers' quarters, the lights are mounted on wall brackets and set in the ceilings.

The boat was built at a cost of over $200,000, and is without doubt the finest of lake steamers running out of Chicago for all prominent lake points. It is 200 feet in length, 40 feet beam and contains 52 staterooms, besides main saloon, toilet and smoking rooms, officers' quarters, kitchen, dining room and freight department.

Praise from Sir Hubert.

A more agreeable journey through diversified and attractive scenery than that which can be made by one of the two daily vestibuled fast trains of the Baltimore & Ohio Railroad between Chicago and Washington, Baltimore, Philadelphia and New York, would be hard to find. The Baltimore & Ohio Railroad of to-day is a vastly different institution from that which it was a few years ago. The antiquated locomotives and cars which then constituted its equipment have given place to rolling stock of the latest and best patterns and the through trains, vestibuled from engine to rear sleeper, and including dining cars and Pullman cars of the most modern and luxurious character, compare favorably with those of any in the world. The sleeping cars especially built for these trains a few months ago have some admirable improvements. The elegant simplicity of the interior decorations is in marked contrast to the louder ornamentation which not long ago was considered the height of art in such places. The wood is of mahogany, with little carved or raised work, but brought down to the highest finish, carefully selected for fine grain and texture, and showing highly artistic cabinet work which the eye does not tire of admiring. The improvement in the locomotive equipment is equally remarkable. In order to climb the Alleghenies, from whose heights the passenger enjoys views of sublimity and beauty which he never forgets, heavy grades and numerous curves were necessary in constructing the road, and, until recently, it required the help of extra engines to get a train to the summit. Now, when the foot of the mountain is reached, instead of two or more engines being called into service, there is attached to the train a single engine weighing 67 tons, having six coupled drivers and cylinders 21x26 inches in size, and this powerful machine takes the heavy train up the long stretches of grades, reaching as high as 118 feet to the mile, at a lively pace. The daylight ride over the mountains, especially in the time of verdure, shows a wonderfully attractive panorama in which grandeur and beauty are constantly mingled, and indeed the entire journey between Washington and Chicago proves the propriety of calling this road "Picturesque B. & O."—*Railway Age.*

The Electric Headlight.

Last week the electric headlight was submitted to another test on the Columbus, Hocking Valley & Toledo Railroad, near Columbus, Ohio, and proved thoroughly successful and satisfactory. A party of reporters were taken out of Columbus on a special train to observe the approach of the electric headlight, which was placed on engine 57. One of them gives the following description:

"The light was clearly and distinctly seen five miles away, and its reflection a long distance beyond. Long before the slightes sound of the approaching train was audible, a newspaper could be read with perfect ease, and as the glaring-eyed monster whirled past, a flood of light enveloped the little group that fairly dazzled with its brilliancy.

"On the return trip, the various scribes took 'turn and turn about' in riding upon the engine. Here it was that the incalculable value of the light was realized. The track stretched away before the whirring train, revealed and visible almost as in a mid-day sun. A closely focused pencil of light pierced out into the darkness, and seemed to penetrate the wall of night.

"Objects were clearly distinguishable along the track for from three to five thousand feet, ample time being afforded to stop the train, even when running at utmost speed, thus precluding the necessity of inestimable loss of life and property. It is the intention of the management, Mr. Rockwell states, to equip each passenger engine with a similar light, if the experiment proves a success, as it certainly seemed to do.

"The lamp is an arc light of some 17 volts intensity. Its working and merits were kindly and carefully explained to the unscientific 'pencils' by W. H. Miller, the new master mechanic of the road, who was of the party.

"The light is placed in the regulation frame, with a dynamo immediately behind it, operated by an independent piston, drawing its steam direct from the main boiler, thus rendering the light independent of the motion of the train."

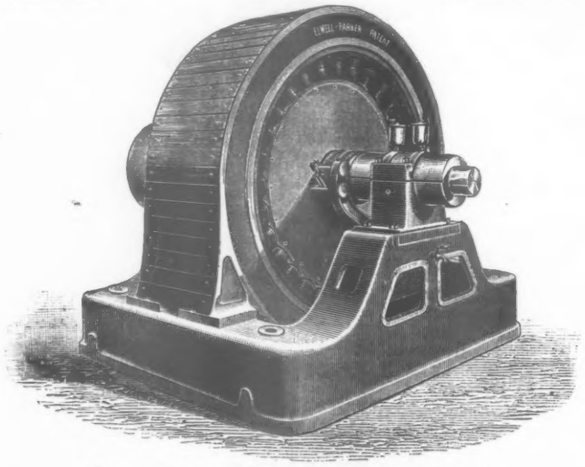
Advance in Platinum.

Dr. Day, chief of the Geological Bureau, in a recent interview, says that platinum is going up alarmingly. The metal, so essential and well nigh indispensable to certain of the mechanical arts, has risen 100 per cent. in value within the last year, and there is every prospect that it will continue to ascend in the market. Nay, more, no reason seems to exist for supposing that it will ever go down again. To-day platinum costs $11.50 a troy ounce; it is destined in all probability never again to be cheaper. "Four-fifths of the platinum that supplies the world is obtained from two mines at Nishnee-Taglisk and Goro-Blagodat, in the Ural Mountains, Siberia," says Dr. Day. "The rise in the price of the metal being due chiefly to the increased cost of its production at the mines, you might suppose that the natural deposits were giving out; but I am credibly informed that such is not at all the case. There are good reasons of a nature altogether different.

"Hitherto the placers of Nishnee-Taglisk and Goro-Blagodat have been richly productive of gold, and the owners of the mines could afford to sell the platinum incidentally obtained for a very moderate price. But now the gold has become scarce, and they are forced to depend to a greater extent upon the platinum for their profits. Of that metal, happily, there is plenty left. Thus you see why it is that platinum has doubled in value within a twelvemonth, and is still rising, with no prospect of going down again.

"But there are other reasons. Until recently the platinum has been carried in guarded wagons from the mines of the Ural to the nearest express station, a distance, perhaps, of 200 miles; but now they are building a trans-Siberian railway, and a great number of laborers, not to be replaced, have been drawn from the mines to build the line. This, for a time, lessens the production of platinum. At present the big dealers are buying up all the old platinum they can lay their hands on, in anticipation of a future rise in prices, so that a 'corner' seems to be arriving in the commodity.

"This increase in the cost of platinum," said Dr. Day in conclusion, "is of an importance to be appreciated when it is considered how greatly the use of this metal has increased of late. Its non-corroding properties make it an invaluable material for chemical apparatus, and probably more of it is employed nowadays in the making of scientific instruments, etc., than for any other purpose. Besides, electricians could hardly get along without it; they utilize it everywhere. an inch of the wire for each incandescent lamp, in connection with telegraphic instruments, and in every place where the passage of a spark creates ozone to oxidize the metal points it passes between. These are only some of the uses of platinum, which will probably never again be half so cheap as it was a year ago."



ELWELL-PARKER ALTERNATING CURRENT DYNAMO.

Electric Lighting at the Edinburgh Exhibition.

The exhibits of dynamos and their accessories at the electrical exhibition now being held in Edinburgh, is very complete and interesting. Among others there is exhibited a large Elwell-Parker dynamo and transformers. This plant consists of a 100 kilo-watt combined alternating dynamo and engine, capable of developing 100 amperes at 1,000 volts, a supply sufficient for 3,330 lamps of 30 watts—16 plants of this type being supplied for the Metropolitan Electric Supply Company, Limited, of London. The high tension current is transformed by means of 12 Parker transformers, which reduce the electro-motive force from 1,000 volts to 100 volts. There are also exhibited two continuous current dynamos erected on tension frames in working order. Each machine is capable of simultaneously exciting the field magnets of the alternator, charging the storage battery, lighting 120 sixteen candle-power lamps, and running two motors. Our illustration, taken from London *Industries*, shows the alternating current dynamo.

To Give Light to the Animals.

The Cincinnati Zoological Gardens, which has justly become famous the world over, not only on account of the magnificent gardens and the romantic scenery, but also for the valuable collection of animals it contains, is about to be illuminated by electricity. The Westinghouse Electric Company received the contract a few days ago to install one of its 40-light dynamos of the Westinghouse alternating arc light system within the Zoo.

With her new Union Station, new opera house, new government building and new electric cars, Norwich will have a word or two to say to her talkative neighbor down at the mouth of the Thames soon. Shade of Cæsar! New London has not even *horse* cars yet.—*Norwich, Conn., Weekly.*

More Room for the Wenstrom.

The Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, Md., finding its present works at Locust Point totally inadequate for the growing business, has purchased the Five Mill property, at Calverton, and will erect there a large building equipped with all the latest improved machinery. Contracts have been made for the grading. Work will be commenced at once.

The Bermuda Cable and the Weather Reports.

The Boston *Journal* published recently a despatch stating that Bermuda was to be connected with Halifax by cable. Then weather reports can be received from those islands, showing the state of the wave in that locality, and whether it is normal, or if there is anything to indicate that an obstruction has formed. If there are any indications of the latter, then a "sea turn" may be predicted for the northwestern coast of the country. This is a step in the right direction to enable weather forcasters to determine whether the ordinary weather or an "easterly turn" may be expected for the coast in this vicinity.

The greatest value of a reporting weather station in the Bermudas, however, is during the West Indian hurricane season, when the position and depth of this adjacent high barometer area determine whether the hurricane will devastate the Atlantic or Gulf coasts of the country, ravage the inland country, or remain out at sea.

There can be no better idea formed of the causes of weather changes than that they are brought about by disturbances in an ocean of air, having its currents, waves and whirlpools—the larger ones, storms; and the smaller whirls, tornados.

Mayrhofer's Time System.

It is seldom that the three forces, electricity, hydraulic pressure and pneumatic action, are so beautifully and perfectly combined as in the Mayrhofer system of time distribution.

Many attempts have been made heretofore to introduce a time service for public and private buildings in which a number of subsidiary or secondary clocks are operated from a central clock or regulator. These attempts have failed to give satisfactory results; partly owing to the agencies employed in transmitting power from the central regulator to the secondary clocks; and partly because the means proposed were not adapted to the different requirements of a well appointed time service.

After many experiments, continued for a number of years, Mr. C. A. Mayrhofer, of Vienna, Austria, has succeeded in developing an electro-pneumatic time system which fully meets with the requirements above set forth. It consists of a central apparatus, a master clock or regulator, and a series of secondary clocks which are connected with the central apparatus by a system of line pipes. The master clock or regulator is in electric connection with the central apparatus, and opens at certain intervals of time—say every half hour or hour—the supply cock of a main pipe by which water is supplied to ejectors which are connected to the line pipes, and which produce a vacuum in the same, which vacuum is made use of in the winding up and setting all the secondary clocks in the system. When this is accomplished, the supply clock is closed, and the central apparatus restored to its normal position, so as to be ready for work when the next winding and setting of the clocks is to take place. The connection between the master clock and the mechanism for opening the supply cock is made by an electric circuit which is closed at regular intervals, so as to operate an electro-magnet, the armature of which releases the driving mechanism of the supply cock, so that the same is operated at the proper moment for supplying the hydraulic force by which the vacuum is established in the line pipes leading to the secondary clocks. These clocks are each provided with an oscillating lever that is connected by a spindle with a diaphragm, located in a hermetically closed casing or shell, which is connected to the line pipe so that by the lifting of the diaphragm by the vacuum produced in the line pipes, the actuating lever is raised, and a hand setting fork operated, which engages a crank arm on the arbor of the minute hand, so as to set the hands, while a pawl and ratchet mechanism, operated by the main lever, winds up the spring or weight of the clock, so as to enable it to run in a regular and re-

liable manner until the next rewinding takes place.

The central apparatus, with the master clock, is shown in Fig. 1, while in Fig. 2 the working mechanisms of the central apparatus are shown on a larger scale. Fig. 3 shows a rear view of a clock movement, with its winding and hand setting attachment.

The advantages claimed for this system are:

That any number of clocks, up to 500 clocks, can be operated from one and the same central apparatus, which is put up at any suitable place in the building in which the time service is arranged.

No winding up of the central apparatus, or interference of any kind with the same is necessary, inasmuch as the same performs its functions regularly and automatically by the joint action of electric, hydraulic and pneumatic forces.

The secondary clocks are absolutely and reliably kept in synchronism with the master clock, and wound up by the central apparatus.

Even when, for some reason or other, the water supply should fail, or an accidental break in one of the line pipes should occur, the secondary clocks will continue to run until the cause of the accident is removed, or the defect repaired, so that no interruption of the time service can take place.

It is possible to include in the system of clocks controlled by the central apparatus, tower clocks and their striking mechanisms, a feature which cannot be accomplished by any of the time systems heretofore in use.

The central apparatus, with its master clock, forms an attractive and ornamental feature of the building in which it is located, and supplies, by the secondary clocks, standard time to any part of the same, whatever be the distance of the clocks from the central apparatus, and whether they are located on the ground floor or top story of the largest office or public building.

The Electro-Pneumatic Time Company, 45 Broadway, is actively engaged in bringing this system of time distribution to the attention of the public.

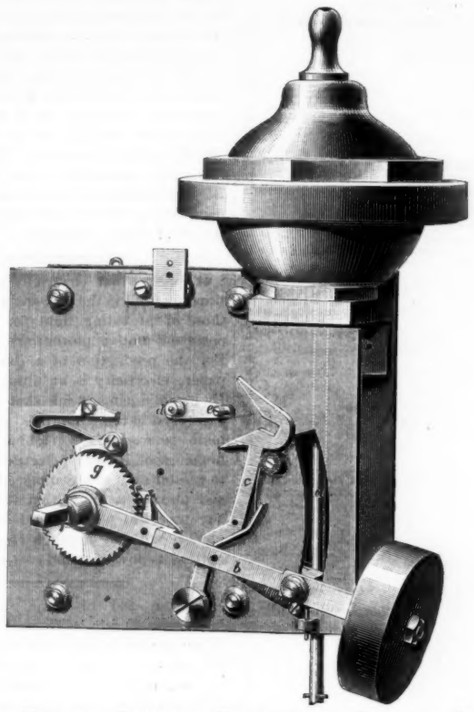


FIG. 3.—REAR VIEW OF A SECONDARY CLOCK, WITH ITS PNEUMATIC WINDING AND HAND SETTING ATTACHMENT.

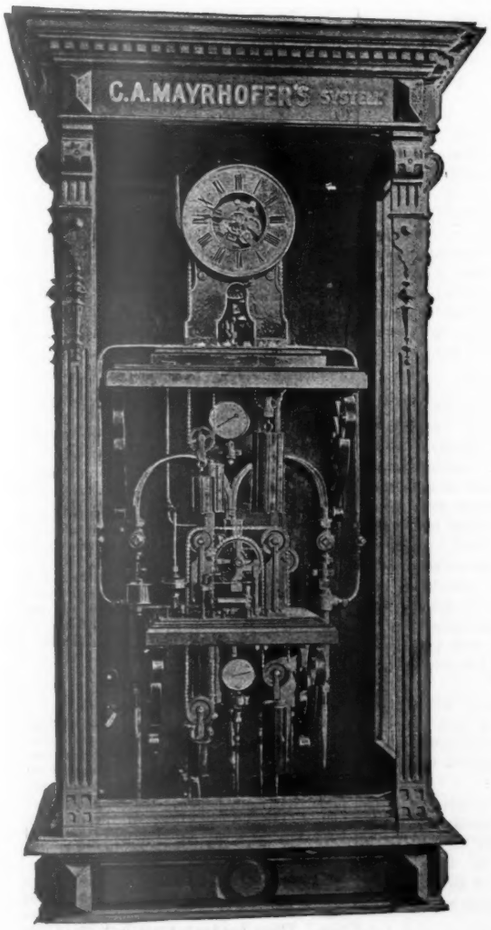


FIG. 1.—THE CENTRAL APPARATUS AND THE MASTER CLOCK, MAYRHOFER SYSTEM.

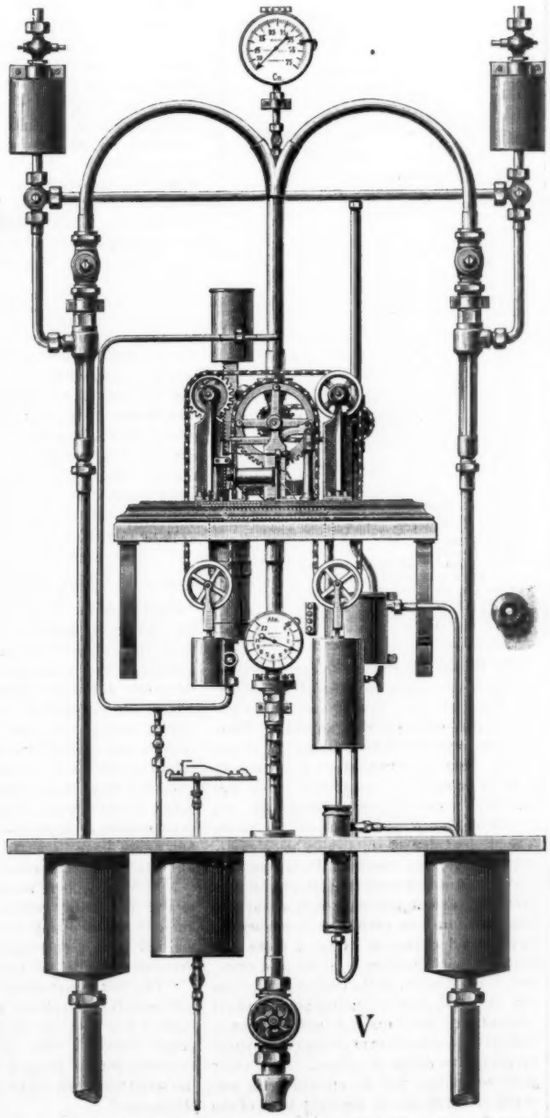


FIG. 2.—ACTUATING MECHANISMS OF THE CENTRAL APPARATUS, IN DETAIL.

Harrisburg, Pa.—Faraday Heat, Power and Light Company; capital, $30,000.

Wellsboro, Pa.—Wellsboro Electric Light and Power Company; capital, $1,000.

Verona, Pa.—Verona and Oakmont Light, Heat and Power Company; capital, $550.

Cincinnati, O.—Jones Brothers Electric Company; amendment enlarging purpose.

Joliet, Ill.—Joliet Electric Clock Company; to manufacture clocks; capital stock, $5,000; incorporators, John Anderson, O. B. Benson.

Fort Worth, Tex.—The Citizens' Electric Light and Power Company, with a capital stock of $20,000. The incorporators are Henry Wells, Harris Schulze and Thomas Lewis.

Lafayette, Ind. — Lafayette Electrical Manufacturing Company; capital, $50,000. The following are the officers: Dr. E. A. Hutchens, president; Prof. H. A. Huston, vice-president; C. G. Longyear, secretary; W. L. Ellis, treasurer.

Houston, Tex.—Houston and Covington Electric Street Railway Company; capital stock, $10,000; incorporators, J. P. Inwin, of Houston; O. W. Crawford, of Kansas City; J. F. Rowley, of Nebraska; B. Kiam and Corra B. Foster, of Houston.

Ogden, Utah.—Citizens' Electric Light Company; capital, $30,000. The officers are: F. J. Kiesel, president; H. W. Smith, first vice president; William Schansnbach, second vice-president; Theodore Schansenbach, secretary; J. A. Boyle, treasurer; F. C. Priestley, superintendent.

A Question for Electrical Men.

"A New York evening paper, in an account of the destruction of an electric lighting plant by lightning during the recent storms, says that 'the dynamo, which had been in use but five months, was ruined by the heat, and the operator was knocked down by the shock.' We have heard of telegraph operators and of typewriter operators, and of various other kinds of operators, but this is the first time we have seen any reference to a dynamo operator. If the engineer who has charge of that dynamo read the account of his misfortunes that we quote from, he must have suffered a second shock almost as bad as the first."

TO THE EDITOR OF ELECTRICAL REVIEW:

I am the *operator* alluded to in the enclosed clipping from my last REVIEW, and would like to ask you to explain the following phenomenon which occurred at the time:

The dynamo room was on the second floor of a two-story building; the lightning struck the building about 30 feet from the dynamo room; directly after the flash, every lamp on the circuit died down almost to going out, and then gradually brightened up again until the potential, which stood at 52 volts when the flash came, rose to 56 volts. Our power is furnished by a waterwheel without governor. After bringing the potential down to 52 volts, the dynamo ran all right for about five minutes, when the heat and smoke obliged me to shut down and leave the building. Examination afterwards showed that the primary fuses in two of the converters were burnt out. One of the converters was about one-quarter and other about three-quarters of a mile from station. All the rest of converters on the circuit worked O. K. till wheel was shut down. Hoping you will explain what caused the lamps to die down, and why only those two out of about 20 converters were injured.

I am, respectfully yours,

H. H. MCGUIRE.

New Berlin, N. Y., June 21st.

ELECTRICAL REVIEW

Published at 13 Park Row

P. O. BOX 3329.

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REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"546 JOHN," TELEPHONE CALL.

BOSTON OFFICE:
W. I. BARKER, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
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No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, JULY 5, 1890.

CONTENTS.

	PAGE.
A Lamp Hour Recorder	1
May Put Out the Light	1
The Evans System at the North Attleboro Steam and Electric Company's Station	1
New York's Possible Shame	1
Remembering the Fourth	1
A Well Lighted Steamship	2
Praise from Sir Hubert	2
The Electric Headlight	2
Electric Lighting at the Edinburgh Exhibition	2
To Give Light to the Animals	2
Advance in Platinum	2
More Room for the Wenstrom	2
The Bermuda Cable and the Weather Reports	2
Mayrhofer's Time System	2
New Corporations	3
A Question for Electrical Men	3
Choice Bit of Telephone News	4
Wanted, a Theatrophone	4
Convention Excursions	4
Another Explosion	4
Correspondence:	
Our Philadelphia Letter	5
Our Boston Letter	5
Our Chicago Letter	5
The International Okonite Company	5
Hollow Filaments	5
Among Our Exchanges:	
Brilliant Heads—One the Editor's	5
Another for the Bawl System	5
General Notes	5
Personal	5
The Treatment of Ores by the Electrolytic Method	5
Telephonic News	6
One Effect of the Subways	6
Against Kemmler	6
The Ocean's "Under-Tow"	6
The Perret Motors	6
Acceleration of Speed on Underground Cables	6
Jest for Fun	6
The Electric Road at Indianapolis	7
On the Theory of Magnetic Lines of Force	7
Telegraphic	7
A Complicated Electrical Suit	7
Electric Power	8
The Otis Electric Elevator	8
Electric Light Securities and Combinations	8
Some Experiments Upon Alternating Current Apparatus	9
Electric Light News	9
Efficiency of the Transformer	11
Measurements of Uniform Magnetic Fields by Means of the Transverse Stress, and on the Permeability of Manganese Steel	13
Electric Clubs:	
Harvard Electric Club	13
Atlanta Electric Club	13
Kansas City Electrical Society	13
New York Electric Club	13
Kindred Interests	14
Our San Francisco Letter	14
Electrical Patents	14

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
Ansonia Brass & Copper Co	4
Armington & Sims	4
Bridgeport Brass Co	4
Brush Electric Co	3
Davis, Charles H., Electrical Engineer	4
Day's Kerite Insulated Wires	4
Eastern Electric Cable Co	4
Edson Pressure Recording Gauges	4
Hampson & Co., E. P.	4
Jewell Belting Co	4
Moore, Alfred F	4
Okonite Co	4
Simplex Electrical Co	4
Standard Underground Cable Co	4
Tucker Electrical Construction Co	4
United Edison Manufacturing Co	2

INSIDE PAGES.

Aluminum Battery Electric Light & Power Co	26
American Bell Telephone Co	19
American Circular Loom Co	16
American Electrical Works	15
Baker & Co	15
Ball Electric Light Co	19
Ball Engine Co	30
Baxter, H. E. & C	29
Bishop Gutta Percha Co	17
Blanchard, C. M	15
Boston Woven Hose Co	29
Brownlee & Co	18
Buckeye Engine Co	30
Burton Electric Co	16
Butler Hard Rubber Co	16
Cary & Moen	17
"C. & C." Electric Motor Co	30
Central Electric Co	18
Chadbourne, Hazelton & Co	26
Columbia National Bank	14
Consolidated Electric Storage Co	17
Clark Electric Co	15
Dwight Slate Machine Co	19
Dreyfuss, Bernard	24
Eddy Electric Manufacturing Co	25
Edison Lamp Co	23
Edison Machine Works	22
Edison Manufacturing Co	30
Electrical Safety Co	15
Elektron Manufacturing Co	15
Empire China Works	19
Empire City Electric Co	26
Eugene F. Phillips Electrical Works, Ltd	15
Eureka Tempered Copper Co	24
Excelsior Electric Co	27
Faraday Carbon Co	24
For Sale	14
Fort Wayne Electric Co	32
Foundry and Machine Department, Harrisburgh Car Manufacturing Co	30
Freeman, Walter K	25
Garvin Machine Co	29
Gordon & Co., W. H	15
Great Western Electrical Supply Co	31
Greeley & Co., The E. S	15 & 22
Hammond Typewriter Co	29
Hazazer & Stanley	23
Heisler Electric Light Co	25
Holmes, Booth & Haydens	27
Horn, Brannen & Forsythe Manufacturing Co	26
Ide & Son, A. L	28
Illinois Electric Material Co	25
International Electrical Exhibition	23
Jarvis Engineering Co	29
Kendall & Slade	22
Lane & Bodley Co	24
Leclanche Battery Co	15
Leffel & Co., James	18
Lehigh Valley Creosoting Co	22
Lynch, E. T., Jr	15
Macfarlane & Co., Wm	15
Marshall, Wm	29
Messner, C. W	14
Mitchell Vance Co	26
National Carbon Co	19
National Electric Light Association Proceedings	19
National Pipe Bending Co	16
Newark Machine Tool Works	15
New England Butt Co	30
New York Belting and Packing Co	24
New York Insulated Wire Co	17
Ostrander & Co., W. R	15
Page Belting Co	17
Palermo Mica Co	30
Parker-Russell Mining and Manufacturing Co	24
Phœnix Glass Co	15
Phosphor-Bronze Smelting Co., Ltd	17
Pond Engineering Co	29
Pope Electric Clock Co	29
Queen & Co., James W	15
Rice Automatic Engine	29
Ricketts Co., Limited (F. M.)	15
Royce & Marean	24
Santley & Co., W. B	19
Sawyer-Man Electric Co	31
Schoverling, A	17
Schuyler Electric Co	23
Seely & Taylor Manufacturing Co	23
Solar Carbon and Manufacturing Co	24
Southern Electrical Supply Co	18
Sperry Electric Co	24
Sprague Electric Railway & Motor Co	19
St. Louis Electrical Supply Co	23
Stephenson Co., John	18
Stevens & Babcock	25
Thomson-Houston Electric Co	21
Trinidad-Heimann Insulated Wire Co	19
Tropical American Telephone Co	17
Tucker Electrical Construction Co	32
United Electric Traction Co	27
United States Electric Lighting Co	15
Vincent & Co., Charles R	29
Walker Electric Co	18
Wanted—Electrician	14
Wanted—Electric Light Salesman	14
Washburn & Moen Manufacturing Co	24
Washington Loan & Trust Co	14
Washington Electric Conduit Co	14
Watson & Stillman	32
Western Electric Co	24
Western Power Construction Co	30
Weston Electrical Instrument Co	19
Whipple Co., The Fred. H	29
Williams & Potter	29
Wilson & Co., R. D	14
Wyckoff Pipe Co	15

The French government telegraph department has completed an exhaustive study of the Paris telephone system and has formulated a plan for entire reorganization. There are at present 12 different exchanges among which inter-communication is extremely difficult, owing to insufficient trunk line facilities; most of these exchanges are also poorly equipped and cramped for room. The original plan of establishing one gigantic exchange for the whole of Paris has been abandoned as impracticable, or, at any rate, defective, and it has now been decided to construct four new exchanges to replace the 12 in actual operation. One of these will be in the Rue Gutenberg, near the post office, and, consequently, in the busiest part of the city where the greatest number of subscribers concentrate; this exchange will accommodate all the subscribers at present distributed between five different offices. The other three exchanges will be erected in the outskirts of Paris, two on the right bank of the Seine and one on the left.

The Italian minister of posts and telegraphs has lately conceived the excellent idea of establishing telephonic communication between all the different towns and villages throughout Italy, and has appointed a commission to investigate the scheme and report on the best means for putting it into execution. There are about 9,000 separate communities in Italy, so the work will be one of no slight magnitude. The plan is all the more remarkable, says *La Lumière Electrique*, from the fact that in 1870 no less than 6,000 of these villages were without any system of public instruction.

It appears that electricity has more missions to fulfil in the newspaper office than those of providing light for general purposes and motive power to run the presses. For the production of a daily illustrated paper, electricity is an absolute necessity. By its aid a pen-and-ink sketch can be photographed in three minutes, and in five the plate is ready for etching. In many branches of industry, electricity is utilized to greater or less advantage, but it is novel and pleasing to know that there are every day processes which could not be accomplished with the despatch requisite, were it not for its powerful and ever-ready aid.

On the 23d of June, Judge James Laurenson died in Baltimore. He had been in the employ of the Post Office Department for fifty-seven years. Immediately after the successful experimental operation of Professor Morse's telegraph between Washington and Baltimore, the line was opened for public business, and, as Morse was especially desirous that the government should assume control of the new enterprise, he arranged to have the Washington office in the post office department building, at the corner of Seventh and F streets. Professor Morse himself was the operator, and Mr. Laurenson, who acted for many years as correspondent of the Baltimore *Sun*, was the first man to use the telegraph for transmitting specials. At that time most of the news from the Southern States, as well as from Mexico and South America, came up the Potomac River by steamer, and by the combined aid of Laurenson and Morse, the *Sun* made many important and startling "scoops."

The Government Telegraph discussion before Congressional Committees has been closed for the season, by the filing of a long and vigorous protest from the President of the Western Union Telegraph Company. The results of the agitation of the subject during this session are a large addition to the Postal Telegraph literature, a defeat of the enemies of the Western Union Company, and a decided growth in the popular feeling that some radical improvement in the telegraphic service of the country is necessary.

CHOICE BIT OF TELEPHONE NEWS.

Our telephone friends often complain of the absence of interesting telephone news from the columns of the technical press. Perhaps they do not always stop to consider that they—the telephone men themselves—are engaged in making telephonic history and at the same time keeping it entirely and most effectively to themselves. Incontestably there is no branch of electrical industry about which so little is published of real interest to those engaged in its development as is the case with telephony; but, as we have indicated, telephonists best know the reasons therefor.

All telephone men, however, will agree as to the interesting accuracy and scientific value of the following item of news, which we cull from a correspondent's letter to a Western electrical journal:

"The first introduction in this city of the anti induction telephone appliance (*sic*) was made a few days ago in the eleventh ward police station. This move has become necessary for the purpose of counteracting the street noise and adds more power to the telephone."

Let the telephone men no longer complain!

WANTED, A THEATROPHONE.

One of the most attractive features of the recent electrical exhibition at the Lenox Lyceum was the telephone companies' section, where visitors were enabled to hear by telephone snatches of comic operas which were being performed at various New York theatres, and also instrumental music, speeches and recitations, from Boston and Philadelphia. A similar arrangement at the Paris Exposition was so successful that the gentlemen who had charge of it have decided to establish a "theatrophone" in a central part of Paris.

The "theatrophone" will be in communication with the principal theatres and other places of amusement, and a novelty which will, no doubt, prove very attractive, has been added to the usual programme, in the shape of a spoken news letter. At stated intervals, five minutes will be devoted to a recital from one of the Press centers of the most important items of news collected up to, not the "hour of going to press," but "the minute of going to phone." A regular price will be charged for a certain period of listening, and in addition subscription tickets will be issued at a reduced rate in order to encourage regular patrons to drop in nightly to hear their favorite gem of opera or concert and learn the latest news of the hour.

We should imagine that a similar venture would meet with great success in New York, especially with the addition of the news message feature, as the craving of Americans for "news" is well known to be insatiable. A "theatrophone" on Broadway, in the vicinity of Madison Square, would no doubt find plenty of patrons and we offer the suggestion free to enterprising telephone men. Such an establishment would be a good advertisement for the telephone companies, also, and help to familiarize the public with the use of the instrument; probably nine-tenths of the population have never used a telephone and it would certainly be to the interests of the companies to reduce the number of those who are unfamiliar with the commodity they supply.

CONVENTION EXCURSIONS.

The London *Electrician* devotes an editorial to the forthcoming three days' meeting of the English Institution of Electrical Engineers, to be held at Edinburgh, in connection with the Electrical Exhibition now going on there. Our contemporary cites the recent general meeting of the American Institute of Electrical Engineers, held at Boston, as an example worthy of imitation, and, in the course of its remarks, says: "Our American cousins do not hesitate to hire an electrical special train—that is to say, not a train motored by electricity, but carrying passengers belonging to the electrical profession exclusively. It is a sensational notion, and is, of course, designed to produce the sensation intended. Our British dignity may not stoop to this kind of advertisement. * * *" For our part, we quite fail to see where the sensation or the advertisement comes in. As a matter of fact the American Institute did not hire a special train to go to Boston in, chiefly because the attendance from New York was not large enough for any economy to be effected thereby. It is usual, on the occasion of the conventions of the telephone and electric light associations, for a special train to be provided for the accommodation of the delegates and their friends, but the end aimed at is to make the journey more comfortable as well as less expensive for the travelers rather than to be sensational or seek advertisement. "Our British dignity" must be a sublime characteristic.

ANOTHER EXPLOSION.

At the corner of Twelfth street and Sixth avenue, on June 23d, another subway manhole filled with gas was ignited, presumably by a fire-cracker. It was in the subway on the west side of the avenue, used for telephone wires and cables. An explosion took place. The upper works of the manhole were carried away, but the wires within it were not damaged. The paving was disturbed for a few feet around.

The explosion was caused by gas leaking into the manhole, which was one of the old ones, without any arrangements for ventilation. There has been great leakage of gas in the neighborhood for a long time.

CORRESPONDENCE.

Electrical Happenings in Philadelphia, Boston and Chicago.

OUR PHILADELPHIA LETTER.

The Edison Lamp Company, Harrison, N. J., to-day broke ground for an addition to their factories. The increased facilities afforded by the new building will raise the production to 25,000 incandescent lamps per day.

Mr. Charles A. Bragg, of the Westinghouse Company, states that he has just sold a 750-light alternating current plant to the Frankfort Avenue Merchants' Electric Light Company. Mr. Bragg thinks a large attendance may be looked for at the Convention at Cape May in August. He places his estimate at 300. Cape May will certainly prove a magnet which will attract a large gathering.

"Cleverly," 1018 Chestnut street, has gotten out some blotters as advertisements. The name is put on in script, the "C" encompassing all the rest. Looks like high tide for Cleverly. What is more to the point, the blotters will blot, which is more than can be said about the majority of such advertisements.

Chadbourne, Hazelton & Company are getting out a new street railway system, embodying the Wenstrom motor and a new gear which is entirely their own. The armature of the motor is kept in motion at all times, revolving at its rate of highest efficiency, whether the car is moving or not. There is no intermediate gear, as in the form of railway motor now in use, but a new hydraulic gear is used, by means of which the axle of the car is thrown in and out of motion with the armature. A test of the apparatus recently held on the Atlantic City Electric Railway is reported to have been very successful.

The United Electric Equipment Company is coming rapidly to the front among the older electrical supply houses. A very good system of electrical mining machinery is sold by this company.

Hottest Day of the season thus far. Business generally is feeling the depression; thermometers, however, are way up.

Philadelphia, June 25, 1890. S. L. C.

OUR BOSTON LETTER.

Mr. James H. Howard, treasurer of the Tropical American Telephone Company, took his departure yesterday for a fortnight's vacation.

West End Railway Company, of this city, feel quite sanguine that its elevated railroad charter will be passed this week through both houses of the Massachusetts legislature and signed by Governor Brackett.

Messrs. F. W. Prescott & Company, of this city, make a specialty of electric stocks. Through the courtesy of this firm, correct closing quotations on the following stocks are furnished every Saturday for publication, viz: Eastern Electric Cable Company, Gethins Electrical Manufacturing Company, Union Electric Car Company and Electrical Safety Company.

Correction.—In my letter of last week I erroneously stated that the Standard Electric Company, of Vermont, would remove to the New England building, this city. This company informs me that its Boston offices will remain at its old quarters, No. 161 Franklin street, where it will continue to transact business and sell the "standard" system for arc and incandescent electric lighting.

The Standard Electric Supply Company has been organized under the laws of the State of Massachusetts, with a capital stock of $10,000. Messrs. William P. Fairbanks, William C Woodward and G. D. Haynes, are the incorporators. The company has leased offices in the New England building, No. 180 Summer street, and will commence business July 1. This new enterprise will manufacture and sell electric light supplies and electrical goods of all kinds.

The Brown Electric Protector Company has made a contract with the Gamewell Fire Alarm Company, giving exclusive right to use the "Brown Protector" on police and fire alarm systems and similar apparatus installed by the latter company or its agents. The Brown Company reports its business as active and prosperous, and is in receipt of several large orders from telephone companies and railroad corporations.

The Brady Mast Arm Company, of New Britain, Conn., expect to have its new factory finished by August 15. This will quadruple the company's present manufacturing facilities, and enable it to successfully grapple with the constantly increasing orders for the "Brady" mast arm. The new storm pulley, lately put on the market by this company, is a very simple and excellent device. It has also just issued a new and attractive catalogue calling attention to its specialties.

The Charlestown Gas and Electric Company, of Charlestown, Mass., is making extensive improvements in its electric light station. These include the addition of one of the largest Armington & Sims engines, together with a new boiler house, containing a boiler equipment of 1,000 horse-power capacity. The company has decided to set its new boilers with the well-known Jarvis patent furnace, manufactured by the Jarvis Engineering Company, of this city. Mr. Geo. B. Neal, treasurer and general manager of the Charlestown Company, was one of the first to adopt electricity in connection with the gas business, and the rapid growth and prosperity of the joint interests with which that gentleman is identified proved him to be enterprising and progressive in his undertakings. Mr. Neal has been ably assisted in his labors in the planning out and erection of the new additions to the station by his superintendent, Mr. Coyle.

Electric Stocks.—Boston quotations, at closing hour of the Exchange, Saturday, June 28, were as follows:

Thomson-Houston Electric Co.	57⅞
" " Preferred	96¾
" " Series C.	18
" " Series D	8¾
Thomson Electric Welding Co	230.
" European Welding Co.	96.
Westinghouse Electric Co.	30¼
Fort Wayne Electric Co.	13.
Eastern Electric Cable Co.	6¼
" " preferred	51¾
Gethins Electrical Manufacturing Co.	2¾
Union Electric Car Co.	5.
Electrical Safety Co.	3.
Western Union	83¾
TELEPHONE:	
American Bell	239.
Erie	48¾
New England	54.
Mexican	1.05
Tropical American	1.50

Boston, June 28, 1890. W. I. B.

OUR CHICAGO LETTER.

The Banquet given by the Chicago Electric Club was looked forward to by the members with great interest, and was held on Friday evening in the Banquet Hall at Kinsley's restaurant. At an early hour members, accompanied by their wives, lady friends and guests, began to assemble, until the rooms of the Club were well filled, and at 8 o'clock supper was announced and a start was made for the Banquet Hall, the party being led by Alex. Kempt, chairman of the house committee. The tables were beautifully set, the hall decorated, while from the balcony came music from Prof. Señor Cobarubia's mandolin orchestra. Suspended from the ceiling directly over the seat at the head of the main table was a beautiful star composed of roses and incandescent lights, loose flowers being scattered over the long tables.

After cigars were lighted the gentlemen adjourned to the Club rooms and listened to two very interesting papers, by J. E. Serble and J. K. Pumpelly; at the conclusion of the papers, an adjournment was made to the ball room, where dancing was enjoyed by all. The following is a list of those present: R. E. Lee, W. A. Hovey, Fred. De Land, H. A. Armstrong, B. E. Sunny, W. A. Kreidler, D. B. Dean, F. E. Degenhardt, Geo. C. Bailey, W. S. Boyd, Geo. Cutter, Chas. E. Gregory, A. C. Dueborow, W. W. Nichols, F. M. Ireland, Frank L. Perry, W. F. Collins, H. R. Hixson, Geo. Buckley, G. M. Smith, J. W. Dickerson, Ernest Hoefert, W. B. Pearson, T. G. Greir, J. K. Pumpelly, J. B. Carney, Alex. Kempt, J. B. Payne, A. Schelble, K. McLennan, W. J. Buckley, S. J. Keese (San Jose, Cal.), M. A. Knapp, H. L. Reiwick, C. M. Spaulding, W. H. Harding G. A. Harding, Mrs. Sunny, Mrs. Degenhardt, Mrs. Cutter, Mrs. Carney, Mrs. McLennan, Mrs. Keese, the Misses Gass, Kempt, Parker, Buckley, Walker and others.

Mr. Charles Munson, president of the Munson Belting Company, accompanied by his wife, son and daughter, had a narrow escape from serious injury while driving, one evening, this week. The horses became frightened and unmanageable and dashed away at a frightful speed; after running over a mile the carriage was overturned and the occupants thrown out; none, however, sustained serious injury.

Personal.—W. S. Heger, general manager of the Edison Company, on the Pacific coast, was a recent visitor in the city.—J. E. Wilson, of the Western Power Construction Company, left on Thursday for an extended trip through the East.—Walter K. Freeman was a recent visitor in the city. D. B. D.

Chicago, June 28.

At St. Louis, Mo., the South Broadway line (Short system) is again in operation, cable construction having been pushed beyond the lines of the electric railway, and the St. Louis Railway Company is to be congratulated upon the complete and high class electrical equipment with which their road has been supplied. The "silent motor," as the Short motor has been named, is quietly making its way over the three miles of track with regularity and ease, and the full capacity of the road, 13 motor and eight trail cars, is needed to accommodate the heavy travel.

The International Okonite Company.

AN IMPORTANT DEAL IN ELECTRIC WIRE CIRCLES.

The International Okonite Company has been incorporated under the Limited Liability Companies' Acts, of Great Britain, and has been formed to acquire the remarkably successful business of the well known Okonite Company, of New York, which manufactures insulated wires and cables for electric and other purposes. The plant is located at Passaic, N. J., and was recently illustrated in the REVIEW. It has also acquired the wire and cable works of Messrs. Shaw & Connolly, of Manchester, England. Both concerns and their operations have been thoroughly examined by expert accountants and engineers.

The directors of the International Company are: Lord Greville, S. W., chairman; Samuel Pope, Q. C., deputy chairman; Major Jones, R. A.; Sir Alexander Armstrong, K.C.B., F.R.S.; Harry Dobree, of Samuel Dobree & Sons, Bankers; and the following New Yorkers: John H. Cheever, John L. Martin, H. Durant Cheever, F. Cazenove Jones, W. L. Candee. The New York directors will act as a local committee in this city.

The new company announces that the present management of the Okonite Company has been secured for the International Company for five years.

This important deal was made by Woodhouse and Rawson United, Limited, of London. The capital of the new company is £340,000.

Hollow Filaments.

A patent was issued June 24th upon an invention of Thomas A. Edison for a tubular filament for an incandescent lamp. The filament is made by winding a metal core with tissue or other paper, or coating it with paper pulp or cellulose in some other suitable manner, thus producing a thin sheath of carbonizable material about the thin filamentary core. In lieu of the metal core, resin, pitch, or other material capable of being dissolved out, may be used. It is proposed in certain cases to cause the metal core, where such is used, to be melted during carbonization, and thus free the carbonized hollow filament from its metallic interior. The completed filament has an arch shape similar to those now in use. The result of this treatment is an incandescing conductor of very high resistance.

AMONG OUR EXCHANGES.

Brilliant Heads—One the Editor's.

From a periodical formerly devoted to the gas interests, but which has now taken up electric lighting in addition, we learn that "it is proposed to light up horses' heads with electric light during fogs in London." No details are given, however.—*English Mechanic.*

Another for the Bawl System.

Since they turned on the electric light in St. Charles, the cows are getting fat pasturing in its streets. They don't know when darkness comes now, and they keep right on eating the whole night through.—*St. Louis Chronicle.*

General Notes.

Proposals for lighting the streets of Herkimer, N. Y., with the electric light are being received.

Bushnell, Ill., is on the verge of an electric light "boom." The citizens of that city hope soon to have brighter illumination than they now have.

It is announced that a joint stock company has been organized by Chicago capitalists, with a capital of $400,000, to put in an electric light and gas light and fuel gas plant in Quincy, Ill. The company will ask the right of the city to make such use of the city's streets as shall be necessary for the putting in of the plant. The company proposes to put its wires either above or below ground as the city shall direct.

PERSONAL.

Mr. James Pollock McQuaide was married on Thursday to Miss Sara S. Parke, at Sea Girt, N. J. Mr. McQuaide has a large circle of electrical friends, all of whom will heartily congratulate him on his assumption of matrimonial responsibilities.

Mr. Erskine J. S. Van Houten, member of the Electric Club, was married June 18th, to Miss Kate L. Blauvelt, at New York, N. Y. The REVIEW joins Mr. Van Houten's many other friends in extending best wishes.

Mr. W. T. Beidler, a successful electric light man, of Baltimore, was a visitor in New York last week, with headquarters at the Electric Club.

Mr. Timothy Wilson Sprague, one of the bright and keen intellects of the Thomson-Houston Motor Company, made a flying business trip to the metropolis, last week.

Mr. H. C. Haskins and wife returned on the steamer "Lahn" from a six months' trip abroad.

Mr. F. A. Forbes, of the Michigan Telephone Company, was in New York last week looking into the telephone business of the East, and hobnobbing with Secretary C. H. Barney, of the National Telephone Exchange Association.

Mr. F. Z. Maguire, member of the Electric Club, and a successful young financier, well-known in phonograph circles, has opened an office at 18 Wall street, this city, for the purpose of handling electrical securities. Mr. Maguire will make a specialty of contracting for electric railways.

The Treatment of Ores by the Electrolytic Method.

A well-known writer states in his work on metallurgy, in reference to the electrolytic treatment of ores, that:

"During the last 40 years, many attempts have been made to extract metals from their ores by electrolysis, and many ingenious processes have been devised, but few of these, so far as we are aware, have proved successful. Some of the earlier investigations of Bunsen, Saint Claire, Deville and Becquerel, are of special importance as indicating the general principles upon which such electrolytic operations may be conducted; there is little doubt, however, that such has yet to be done before the separation of metals from their ores will attain the position of a really practical branch of electro-chemistry. We have noticed in the cases of copper refining by the wet way, that many attempts were made in this direction long before a commercially successful application of the electrolytic method was arrived at, and we still hope and believe that electricity will yet be practically employed in extracting metals from their ores; indeed, some trials which we have recently made in this connection are at least of a very hopeful character."

This paragraph could now well be eliminated from this work. Electrical engineering firms for the past three years have given this branch of the profession great attention, and with the result that their efforts in constructing dynamos especially adapted for this work have been successful. The United Edison Company, with their unusual facilities for the manufacturing of generators, promptly exploited this field, and are now turning out dynamos to develop any amount of current requisite for the capacity of the works treating the ores.

Many mine owners and operators of existing plants treating ores in the old method have, from time to time, been considerably exercised in their minds in reading and hearing reports of the marvelous statements that have appeared about the output of the establishments already provided with plants for treating copper ore electrolytically.

1. The pureness of copper deposited.
2. The recovery of the gold and silver obtained by no other method.
3. The cheapness of production,
4. The ready sale of the product.

These statements are so far true, but the owners, on investigating the matter, have had great obstacles thrown in their way, getting no information as to the construction of the plants, and being told that the method is altogether conducted in a secret manner. This, consequently, has dampened their ardor, and they have returned to their old system of conducting their operations. But the Edison Company states that there is no real secret process. Owners of electric plants have, however, only adopted the ordinary wise and business caution of, when they have a good thing, keeping it as far as possible to system. The United Edison Company, with a thorough knowledge of the whole business, can now contract with parties to furnish them with a complete plant, including motive power and generators, baths, pumps, and with all the necessary information for conducting, with financial success, the operations of treating ores by the electrolytic method.

Telephonic News

*** A dividend of $1 a share, and an extra of $6 a share have been declared on American Bell telephone stock.

*** A test of the long distance telephone was made between Paris and Calais, on June 26th. The experiment was in every respect successful, and a trial will shortly be made between Paris and London.

*** The National Editorial Association held an annual convention in Boston last week. One of the features of the meeting was a long distance telephone entertainment. The usual Boston-New York musical programme was given, and the editors were immensely amused and pleased.

*** The American Bell telephone output for the month ending June 20, is as follows:

	1890.	1889.	Inc.	Dec.
Gross output.....	7,758	6,511	1,247	....
Returned.....	1,927	2,094	....	167
Net	5,831	4,417	1,414	....
Since Dec. 21,	1889-90.	1888-89.	Inc.	Dec.
Gross.....	33,577	30,216	3,361	....
Returned.....	12,104	11,281	823	....
Net	21,473	18,935	2,538	....

*** E. M. Jackson, of Chicago, has been engaged by The Pacific Telephone and Telegraph Company, of San Francisco, to take charge of laying the telephone wires underground in the business section of the city. He expects to have ten miles of wires buried within a year. Mr. Jackson is now in the East, examining the different systems of conduits.

*** Mr. H. J. McCartney, who is the manager of the New York office of the American Telephone and Telegraph Company, has laid plans for an experiment which will give persons aboard a yacht the same opportunities as those on land. His intention is to run a cable from the foot of East Twenty-sixth street to Commodore Gerry's "Electra." This will surely operate well, so experts say, and if it does the Commodore will be the first person to have music shipped from a theatre to a vessel as it is reeled off by the orchestra.

One Effect of the Subways.

The Gas Commission, at a meeting in the Mayor's office, on June 26th, rejected all the bids for street lighting made by the electric light companies. In their proposals, put in last April, the companies united in asking about 20 per cent. more than last year's prices. The increase was on the ground that the rent of subways and other expenses incidental to the destruction of their overhead wire systems rendered it impossible to do the work at the old figures. But the members of the Gas Commission could not see it in that light and said that the bids were all too high. Besides that, they claimed they could not have made the contracts at the increased price without exceeding the appropriation. The companies were told to put in new bids, they agreeing meanwhile to go on under the old contracts. But when their bids came in all but the Harlem Lighting Company charged the new prices. New bids have again been called for, and if they are not low enough to come within the appropriation, the Commission state they will go back to gas for street lighting.

Against Kemmler.

The case of the people *ex rel.* Kemmler *vs.* Durston, Warden of the Auburn State prison, came up before the Court of Appeals, on June 24th. W. Bourke Cockran argued for Kemmler on the sole question whether the legislature had the power to legislate so as to take away any of the duties or powers of any sheriff of any county, as it did in the present case, and invest another officer, as in this case, with that power. Attorney-General Tabor began his argument by reviewing the course of the counsel for Kemmler in going through all the courts in the country in behalf of his client, when Chief Justice Roger cut him short by remarking that further argument was unnecessary, as the court was ready to render a decision at once. The decision is, in effect, that the court believes that the legislature had the power to make the law in question, and that the decision of the lower court is affirmed.

It is not believed, says a Buffalo despatch to the New York *Sun*, that any further obstacle will be offered by the Buffalo counsel of William Kemmler to the execution of the death penalty in his case. At least Lawyer Charles S. Hatch, who represents Kemmler, says that he has no present idea of interfering, and District Attorney Quinby says that the technicalities of the law are exhausted, and he cannot see how any judge would interfere this time. If an injunction suit is brought against the State to prevent use of the dynamo the authorities here believe that it will be quickly disposed of. Such a suit could only be brought by the electric light company which manufactured the dynamos. Judge Henry A. Childs, who has twice before sentenced Kemmler, has not decided the date for the execution, but he will undoubtedly fix it for the week of August 4th. He may be governed by the wish of Warden Durston. The judge will simply give an order that the sentence heretofore pronounced shall be carried into execution during the week decided upon.

Kemmler was first sentenced on May 14, 1889, to die during the week of June 26, 1889, and again on March 31, to die in the week of April 28, of this year.

FIG. 2.—PERRET MOTOR APPLIED TO A SEWING MACHINE.

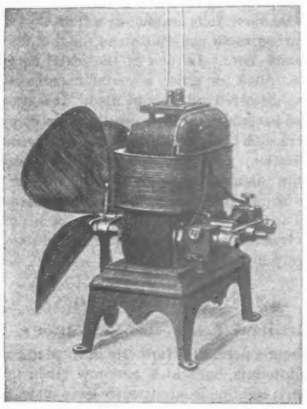


FIG. 3.—PERRET MOTOR FAN.

The Ocean's "Under-Tow."

Doubtless, we have all heard a great deal about this "under-tow," as though it were some mysterious force working from the recesses of a treacherous ocean to draw unwary bathers to their doom, says Duffield Osborne, in July *Scribner's*.

As a matter of fact its presence is obviously natural, and the explanation of it more than simple. As each wave rolls in and breaks upon the beach, the volume of water which it carries does not remain there and sink into the sand; it flows back again, and, as the succeeding wave breaks over it, the receding one forms an under current flowing outward of strength proportionate to the body of water contained in each breaker, and, again, proportionate in a great measure to the depth of the ditch. Where this latter is an appreciable depression, it can be readily seen that the water of receding waves will flow into it with similar effect to that of water going over a fall, and that a person standing near is very likely to be drawn over with it, and thus, if the ditch is deep enough, carried out of his depth. This is all there is to the much-talked-of "under-tow" and the numerous accidents laid to its account.

The Perret Motors.

The Elektron Manufacturing Company have just had printed for distribution, a little pamphlet relating to battery motors, batteries and their applications.

In Fig. 1 is shown a primary battery of two cells, a Perret electric motor (type *A. O.*, single speed), wires connecting them, and a switch in the circuit for stopping and starting motor.

With the three-speed motor no switch is needed in circuit, as the motor is itself provided with a switch.

Fig. 2 represents an outfit for doing family sewing. It consists of a Perret motor (type *A. O.*, three-speed), an adjustable clamp by which it is attached to the table back of the machine, and a ⅛-inch round leather belt which transmits the power from the small grooved pulley on the motor to the pulley on the machine, as shown. Two wires lead from the binding posts on the motor to the battery, which may be located in any convenient part of the house, as for instance, in a closet, bath-room or shed.

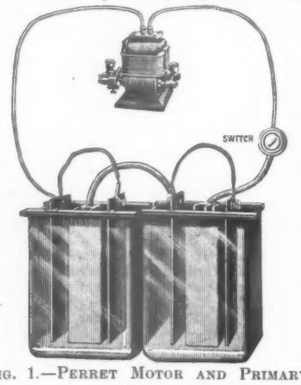


FIG. 1.—PERRET MOTOR AND PRIMARY CELLS.

A cord is attached to the switch on motor, carried over a small grooved guiding pulley, and thence down to the treadle. A slight pressure of the toes on the treadle will start the motor slowly, and further pressure will increase the speed. By the reverse motion the switch is turned off and motor stops.

The control of speed and of stopping and starting is so perfect and so simple, that it may be readily operated by a child of five years.

The cost of running with suitable primary batteries, is said to be one to two cents per hour, according to speed and character of the work.

A battery of three two-volt cells is generally used, with a current of three to six amperes, according to speed and character of work.

If the cells have very low internal resistance, as in the case of storage batteries, two cells are sufficient.

The Perret motor fan is shown in Fig. 3. This little luxury is too well known to need any description.

Acceleration of Speed on Underground Cables.

A series of experiments made by Mr. Grawenkel on cables varying in length from 500 to over 1,100 kilometres, showed that by means of Delany's method of alternate currents of equal duration, it was possible to accelerate the speed of signaling to a considerable extent, and to increase the length of cable over which a message could be sent directly; but that these advantages were gained at the expense of simplicity and of clearness in the transmitted signals.

In consequence of these experiments, the German Telegraph Engineering Department proposed the problem of devising means of accelerating the speed of transmission without discarding the ordinary transmitter, and without any change either in the direction or duration of the currents. The factors to be considered were the resistance of the sending battery, the electrostatic charge of the cable, and the self-induction of the apparatus; and what was required was to make the battery resistance as small as possible, to accelerate the discharging of the cable, and to compensate the self induction of the receiving apparatus.

The low battery resistance was obtained by using cells connected in parallel, or accumulators. A resistance short circuited through a condenser, as suggested by Maxwell, and put into practice by Stearns, was introduced between the receiving relay and the earth.

In the case of overland telegraphs, the resistance R, and the capacity, S, of the condenser should be related in accordance with the equation, $S R^2 = L$, where L is the coefficient of induction; but in the case of underground cables, the relation had to be determined experimentally. Some experiments on a cable 595 kilometres in length then showed that, calling the speed of transmission with the Morse apparatus, 100, the addition of the resistance and condenser increased it to 131; while with Delany's method the speed was only 112 without resistance and condenser, and 123.5 with them. This inferiority of Delany's method when a resistance and condenser are employed is to be attributed to the fact that Delany's key cannot be worked as rapidly as the ordinary Morse key.

The speed was still further increased by the adoption of an arrangement for short circuiting the coils of the receiving relay at the moment of receiving a signal, the result of which is to accelerate the discharge. The resistance of the short circuit should be as low as it can be made while allowing the relay to repeat the Morse signals, and its value must therefore be determined experimentally.

The results obtained show that it is possible, without the use of specially constructed sending keys, or of alternate currents, to transmit signals over underground cables 500 or 600 kilometres in length as rapidly as through overhead wires. A series of experimentally obtained curves illustrating the theory of the improved arrangements, are given in the paper.

JEST FOR FUN.

In a recent issue a Pittsburgh daily paper stated that a "writing telephone" was to be established in that city. The article then went on to describe the Essick "printing telegraph."

Angry caller (at newspaper office)—Say, I want that little ad. I gave you two days ago—"Wanted, an electric battery in good working order"—taken out.

Advertising clerk—What is the matter? Didn't we give you the right location?

Angry caller—Location be dashed! The blamed ad. overdid the business. My house was struck by lightning last night!—*Chicago Tribune.*

He stood watching the men at work laying the conduits for the electric light wires in the trench at Grand Circus park. In fact, he apparently had nothing else to do all day, except look wise and furnish information as to what the men were doing, to passers-by. "Why do they put in two pipes?" asked a man, as he hurried by. "You make me tired," said the autocrat of the trench side. "Every one knows that they have to have one pipe for the electricity to come out in and the other to take it back to the works."—*Exchange.*

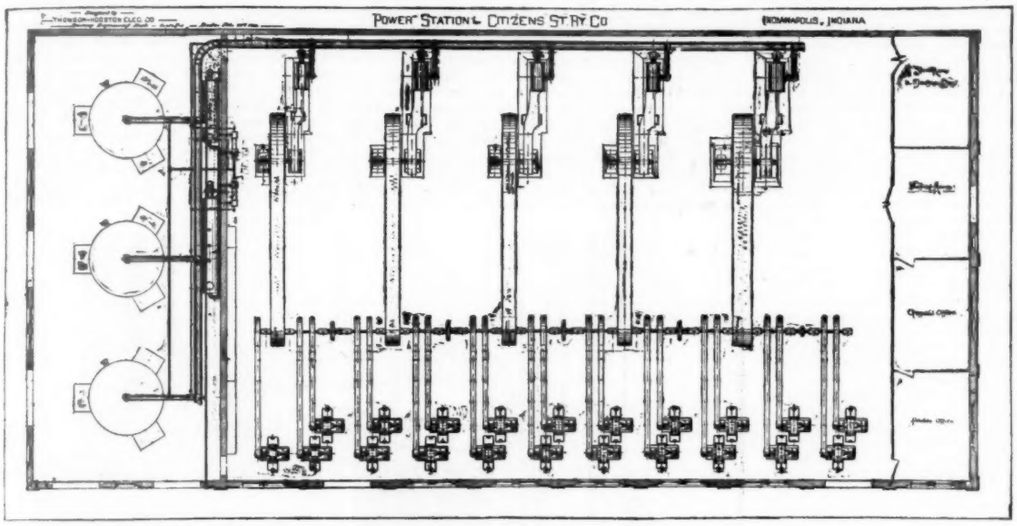
The Electric Road at Indianapolis.

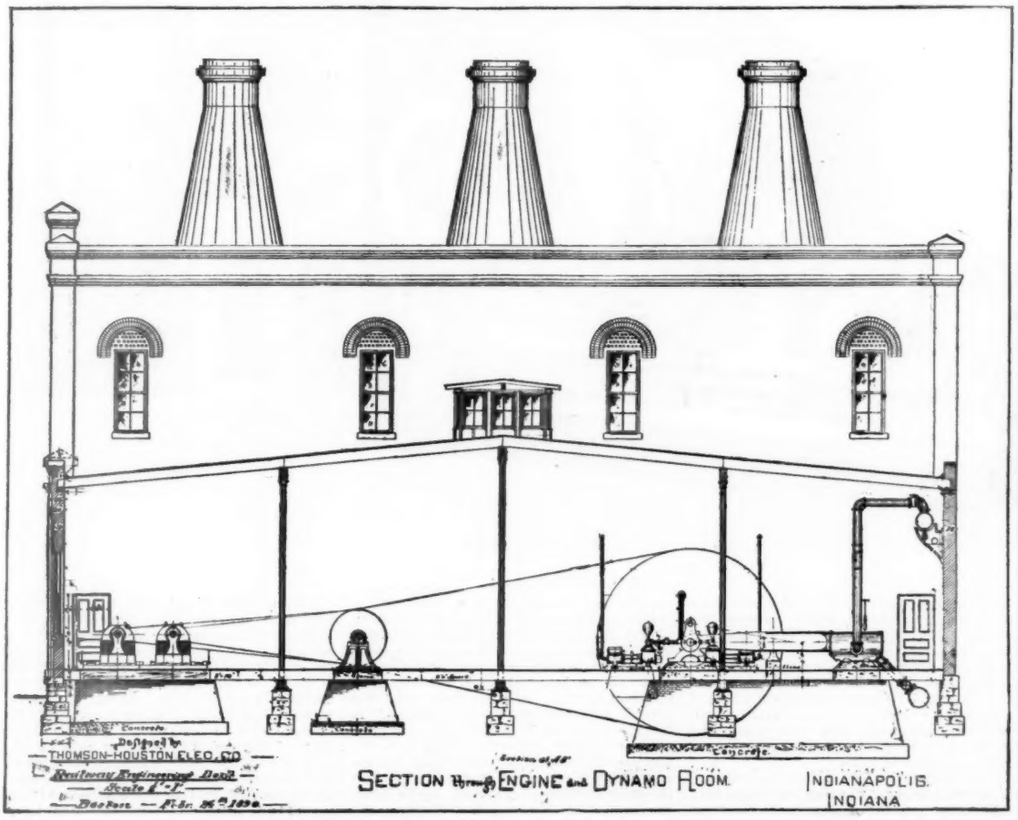
The Power Station for the Citizens' Street Railway Company at Indianapolis, Ind., is a handsome brick structure, as shown in the engraving printed in this issue. It is of sufficient capacity to contain 23 Thomson-Houston railway generators, and at the same time afford office room and general machine shop. The boiler plant is to consist of three Hazelton boilers, fitted to burn natural gas, and also arranged with furnaces to burn coal, as shown by the three extensions to each boiler on the plan. The gas burners in each boiler are located in such a manner that they do not interfere in the slightest with the coal furnaces, it being possible to make a change from gas to coal at a moment's notice. This is a very great advantage over the ordinary practice, as it is customary to place these burners on the grates, and which, in case it was desired to use coal, would have to be removed.

The feed water for the boilers is first passed through a Hoppes purifier, which removes the impurities and heats the water at the same time up to boiling point. From this heater the water is pumped by Barr duplex pumps into the boilers. Everything about the feed water system is arranged in duplicate so that in case of accidental injury, operations would in no way be interfered with.

The general arrangement of this installation is shown by the cut representing a section across the engine and dynamo room. The entire installation rests upon masonry consisting of a concrete base with the brick work on top laid in cement, and everything about the plant is constructed in the most substantial manner possible, and its operation is ample proof of the thorough workmanship and good material employed.

The engine was built by the Wheelock Company, of Worcester, Mass. The entire installation was planned and erected by Mr. L. H. McIntire, of the Railway Engineering Department of the Thomson-Houston Electric Company. The work of installing the plant was in charge of Mr. W. S. Twining.





Any number of the engines can be run at the same time, and any one can be started and stopped while the balance of the plant is in operation. The shafting is made of the best quality hammered steel, and is supported by ball and socket self-oiling bearings. This is the first system that has been equipped upon this plan, and it is highly satisfactory. The steam piping for this plant is of ample capacity and so arranged that when the whole plant is in operation every detail will be of proper size and proportion.

On the Theory of Magnetic Lines of Force.

Mr. K. Kahle's object was to test experimentally the theory of electro-magnetism which has been developed by J. and E. Hopkinson and G. Kapp.

Two bars of soft annealed Swedish iron were bent into the form of horseshoes with parallel limbs, and each limb was partially surrounded by a magnetizing coil. The electro-magnets were then placed with their poles facing each other, first in contact, and then separated by measured small intervals. The number of lines of force for various current strengths were then determined at the poles, at the bend, and over the magnetizing coils, by means of secondary coils and a ballistic galvanometer. The distribution of the lines of force was also observed directly by means of iron filings, and photographs illustrating the results obtained are given in the paper. The results of the observations were in agreement with the theory under consideration when the interval separating the poles was small, but deviated more and more from those calculated from theory as the interval increased. The author attributes this to the method of measurement employed not being adapted to give correct results when the distribution of magnetic force is of the complicated character indicated by the iron filings for considerable intervals between the poles. This, however, is not of very great practical importance, as in any properly constructed dynamo the ratio of the interval between the poles to their cross section would be small enough to bring them within the limits within which the results deduced from the observations are in agreement with the theory.

TELEGRAPHIC

.... The shore end of the Bermuda cable has been laid at Halifax, N. S., and the steamer "Westmeath" will proceed to sea at once to lay the cable to Bermuda.

.... Mr. J. Noble, an inventive genius of St. Louis, is confident that he has simplified and cheapened the cost of electric motors as used on the overhead system. He has also geared a motor so that the loss in starting a car is reduced to a minimum.

.... In Commissioner Gilroy's 1889 crusade against overhead wires, those of the American Rapid Telegraph Company shared the fate of the others. The company sued the Mayor, Commissioner Gilroy and the Board of Electrical Control, for damages. The judge has decided in favor of the defendants.

.... The local electro-matrix fight at Minneapolis, has at last been decided by the disbandment of the Minneapolis company and the formation of a new one to operate in New York. The capital stock of the new company is $6,000,000, and half of it was traded for the stock of the old company. The S. S. Small faction in the recent contest, now owns all the territory outside of New York, and the matrices will be manufactured in Minneapolis.

.... The Postmaster-General has issued an order fixing the rates on Government telegrams for the fiscal year beginning July 1, 1890. These rates are exactly the same as those of the present fiscal year. That is, on day messages, 10 cents for 10 body words, for not over 400 miles, and half a cent for each additional word. Fifteen cents for 10 words between 400 and 1,000 miles, and three-quarters of a cent for each additional word. For a greater distance than 1,000 miles, half a cent extra for each word added to the price of the message for between 400 and 1,000 miles. For night messages, 15 cents for 20 body words for all distances, and half a cent for each additional word. For signal service weather reports, 2½ cents for each word sent over each circuit established by the Chief Signal Officer.

.... Judge Brown, of the United States District Court, last week handed down a decision in the counter suits for libel brought by the Western Union Telegraph Company and the Inman Line Steamship Company, respectively, finding in favor of the steamship company. The litigation arose over the tearing away of 12 cables of the Western Union Telegraph Company at the Dutch Steamship Company pier, in Jersey City, by the propeller blades becoming entangled in them. The cables got so completely entangled in the blades that the vessel had to be placed on the dry dock for repairs. The steamship company's claim was for $2,000 damages, which was allowed. The amount claimed by the Western Union Telegraph Company was $10,789, which was spent in repairing the broken cables, and $50,000 additional for delay to business. Judge Brown holds that vessels have the right of way over cables, not only in the navigable water but in the navigable mud of the harbor, and so he finds for the steamship company.

A Complicated Electrical Suit.

Thomson-Houston Electric Company in Philadelphia, last week filed the printed bills in two cases in equity in the Common Pleas, against the Macon City and Suburban Street Railway Company, the American Life Insurance Company and the Real Estate Title Insurance Company. The railroad, it seems, contracted with the plaintiff for an electrical appliance for its equipment. The railroad was to pay in bonds, said bonds to be of a mortgage, constituting a first lien upon the entire assets. Since that time the bonds of the road have passed into the possession of the American Life. The plaintiff avers that the said delivery was fraudulent, and asks that the Real Estate Title Company be enjoined from selling or in any way transferring the 260 bonds belonging to them.

* * The citizens of Puyallup, Washington, are generally in favor of subscribing $16,000 to the Tacoma and Puyallup Electric Railway Company, upon the consideration that work of construction shall be begun in 60 days after June 15, and finished within a year following, and on the futher condition that trains shall be run once every half hour during the day until 10 o'clock. The fare is to be fixed at 15 cents each way, or 25 cents for the round trip. Messrs. Anderson and Garretson, of the electric railway company, have not accepted these terms as yet.

* * A new factory building, of wood covered by corrugated shingles, is being built by the Thomson-Houston Company, at Lynn, Mass., which will be devoted to an entirely new use. C. J. Vandepoele, the electrician, whose railway inventions are controlled by the company, has for two years been working on an entirely new principle in electric mining machinery, and has devoloped his apparatus so that most of the inventions are already covered by patents, and application has been made for others. The new factory will be used for the manufacture of these electric drills and other devices, which those able to judge consider as only second in importance to the railroad work.

* * The formal transfer of the bulk of the stock of the Essex Passenger Railway Company, Newark, N. J., to the Philadelphia syndicate has taken place, and many of the old stockholders have received cash for the bonds they hold in the organization. The amount of money that changed hands was about $1,650,000. The transfer includes the stock of the Newark and Irvington and Elizabeth lines. The principal gentlemen who withdrew from the company are William Clark, Alexander Turnbull and S. S. Battin. On account of the withdrawal of these, vacancies were left on the board of directors, and the following have been elected as the new members of the temporary board: Thomas C. Barr, A. Q. Keasley, A. L. Dennis and Andrew Lemassena. Several others, representing the syndicate, will be added to the board. The transfer of the Elizabeth road will probably take place this week. It is the intention of the new company to continue the work of erecting poles up Springfield avenue, and the new electrical system will be established as soon as they are all in position.

* * The city of Richmond, Va., will always be remembered by street railway men as being the place where the superiority of electricity over other methods as a means for propelling street cars was first demonstrated. Although the apparatus installed at Richmond for street railway work was almost the first which had been designed for operating a street railway of any considerable size, the results, as our readers well know, were such as to call forth the admiration of street railway and electrical engineers, and was the direct precursor of the great impetus in electrical equipment which has since followed. It is interesting to note that Richmond is still enthusiastic over electric traction, and that the two other important roads in the city of Richmond—Richmond City Railway and the Richmond and Manchester Railway—have decided to supplant animal power by electrical power. These contracts, the one with the city railway company being for 10 cars, and the Richmond and Manchester road being for five cars, were closed by the Sprague Electric Railway and Motor Company during the last month.

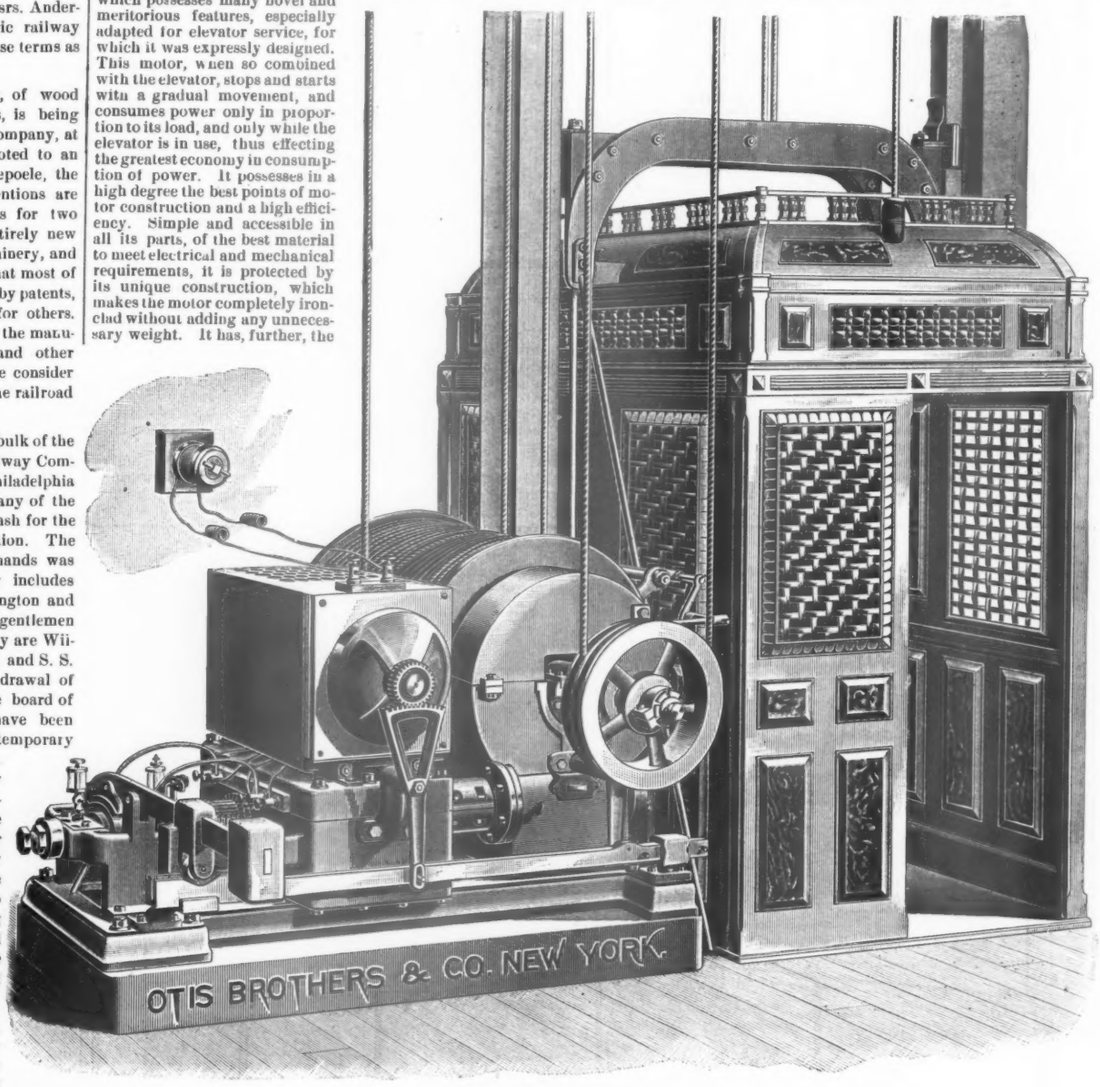
The Otis Electric Elevator.

We have at frequent intervals called attention to the possibility of operating hoists and passenger elevators by electricity. Our illustration shows a passenger elevator thus operated. It is the production of Otis Brothers & Company, the well-known elevator manufacturers, of this city.

By carefully considering the special conditions involved in such a construction, they have succeeded in perfecting an electric elevator which is well suited to many places where it has heretofore been impracticable to use such an apparatus. The winding machinery and safety appliances, including the safety governor, the gravity wedge safety, the automatic stop-motion, and the slack cable stop; also the devices for controlling the movement of the elevator car, are such as they have been constantly building for the past 25 years; consequently, in the elevator proper, there are no experimental features. To give motion to the elevator machinery, they connect therewith and make a part of the same, an Eickemeyer motor which possesses many novel and meritorious features, especially adapted for elevator service, for which it was expressly designed. This motor, when so combined with the elevator, stops and starts with a gradual movement, and consumes power only in proportion to its load, and only while the elevator is in use, thus effecting the greatest economy in consumption of power. It possesses in a high degree the best points of motor construction and a high efficiency. Simple and accessible in all its parts, of the best material to meet electrical and mechanical requirements, it is protected by its unique construction, which makes the motor completely iron-clad without adding any unnecessary weight. It has, further, the special advantage of a powerful field and a short magnetic circuit, which entirely prevents "sparking" at the commutator and affords perfect self-regulation. The motor is so coupled directly to the elevator gear that it starts and stops with the winding machinery, the whole being under perfect control of the operator in the car, thus forming a self-contained apparatus, free from jerky and irregular running of detached gearing, as when operated by belts.

The difficulties heretofore experienced from heating and "burning out" have been effectually guarded against in the construction of this machine; and, in connection with the operating device, an indicator is employed which at all times shows the operator in the car the exact position of the controlling and reversing switch on the motor.

After several years of careful study and practical experiment, and after several of these machines have been in actual service for a number of months, this company is prepared to offer elevator users the first electrical elevator that has been found to be successful in meeting the important requirements of easy and gradual starting and stopping of the car, concurrent action of motor and winding machinery and utmost economy in cost of operation.



Electric Elevator.

Electric Light Securities and Combinations.

The Boston *Herald*, in its financial column, June 17, presents the following interesting and somewhat dazzling statement:

The Thomson-Houston Company has declared a regular semi-annual dividend of 3½ per cent. on the preferred stock, payable July 1 to stock of June 25, the books to re-open July 3. On the same day dividends will be paid on series C and D securities in amount not yet determined, but contingent upon negotiations for the sale of securities liable to culminate before the payment falls due. The gross sales of the company in May were rising $1,000,000, and the map of the United States on the wall of the office lobby has become very red with red spots designating the location of the electric plants supplied or controlled by the Thomson-Houston Company. Fort Wayne stock holders will soon hear something of interest

The rise in Thomson-Houston common stock this morning created surprise in quarters which would naturally be informed upon all matters having a bearing upon intrinsic values. It is, in truth, said that several such parties took advantage of the late rise in the stock to market a good part of their holdings, expecting to buy back at a decline. The stock is not declining. On the contrary, a block of it was sold at 68½ after the stock exchange adjourned. Quite likely the issue of the new Oregon & Transcontinental prospectus, elsewhere outlined, showing an electrical department, including Thomson-Houston Company, had to do with buying.

Touching the sale of Thomson-Houston stock to Mr. Villard and associates, it is interesting gossip that a great combination of electric companies is near, of which Henry Villard will be president, George Westinghouse general manager, President Coffin, of the Thomson-Houston Company, assistant manager, and Thomas A. Edison, general electrician. Boston opinion is that Mr. Villard might be put at the head of such a consolidation, if it was made, but that the allotment of Messrs. Westinghouse and Coffin is not probable. The expectation here is that Mr. Coffin will continue to manage Thomson-Houston affairs the same after the sale of stock as at present, and it is thought possible that the Westinghouse company might sell out to Mr. Villard and continue in the management of the Westinghouse Company on the same plan. The successor of the Oregon Transcontinental Company is expected to finance the electrical combination. It is, indeed, tolerably plain, by inference from what appears in the following paragraph, that the North American Company, the successor of the Oregon and Transcontinental Company, is to be purchaser of the Thomson-Houston common stock, now pooled for sale to an unknown purchaser at an unknown price.

The North American Company is to succeed the Oregon and Transcontinental Company. A circular read at the annual meeting of the Oregon and Transcontinental Company, at Portland, Ore., to-day, reveals this fact, and that it is a New Jersey corporation. Three-quarters of the stockholders consent that the company shall have a capital of $50,000,000, of which $40,000,000 will be issued at once. Stock will be exchanged share for share, 30 days being allowed for the exchange. Stockholders who do not consent will get their share of the assets in kind or cash by appraisal of three trust company presidents. Holders are advised in the circular to come in, because, 1st, that the new company will be prosperous from the start, and will have powerful backers; 2d, the company will have two special fields; one railroad financiering, for which it already has several large and prosperous companies; the other electric light and power enterprises. This affords great opportunity for large capital. The company will be closely affiliated with the Edison General Electric Company, as a stockholder and otherwise, and the Thomson-Houston Company. More detailed information will be given in the final invitation to the stockholders.

Some Experiments Upon Alternating Current Apparatus.

BY HARRIS J. RYAN, BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, JUNE 17, 1890.

It is well known that when the core of a transformer is heated under certain favorable conditions, the secondary will deliver electrical energy in amount considerably greater than when the core is not heated, and that this is done, too, without an increase of the energy that is supplied to the primary. In fact, we are told that on heating the core of the properly constructed transformer, that there will be obtained a diminution of energy taken up by the primary and a considerable increase in that given out by the secondary.

In some recent experiments, made in the Physical Laboratory of Cornell University, it was not possible to obtain the above effect. Mr. L. B. Marks, a student in electrical engineering, at Cornell, made an apparatus that differed materially from the forms that were first made use of, in which he found this phenomenon very marked.

For two reasons do we think that the details of the performance of Mr. Marks' apparatus will be of interest to the members of the Institute: First, that they indicate clearly the source of energy in the phenomenon observed with his apparatus, and second, that they show in exaggerated form certain phenomena that must be done away with in a transformer that is to be used for incandescent lighting.

A good idea of the apparatus will be obtained through a glance at Fig. 1. The core consisted of nine well rusted rings, 1.1 cms. thick and of a mean diameter of 17 cms. each. The number of turns on the primary was 500, on the secondary 155. Size of bare copper wire in each was No. 18 B. and S. G. The wire was insulated with asbestos paper, and, because of its thickness, the primary and secondary turns with their insulation occupied a space of *abnormal* proportions.

Resistance of the primary..... .....1.65 ohms.
" " secondary.....0.71 "

The maximum magnetization used in the core in any of the experiments here described was not above 3,000 lines per square cms.

Diagrams 2, 4, 5 and 6 represent graphically the observations that were made with the apparatus.

From these diagrams are deduced the following results:

Secondary open, no extraneous heat applied—
Temperature of the core... ..... 97.5°C.
Primary E. M. F..... 75.6 volts.
Secondary E. M. F..... ..... 16.4 "
Ratio 75.6 / 16.4 ..... 4.6
Secondary current 0.0
Secondary open, core heated—
Temperature of core.....300°C.
Primary E. M. F ..... 99.4 volts.
Secondary E. M. F ..... 24.5 "
Ratio 99.4 / 24.5 4
Secondary current..... ..... 0.0
Secondary closed, no heat applied—
Temperature of the core.....100°C.
Primary E. M. F..... 89.3 volts.
Secondary E. M. F..... 11.9 "
Ratio 49.3 / 11.9 ..... 8.1
Secondary current..... 2.0 amperes.
Secondary closed, core heated—
Temperature of core.....270°C.
Primary E. M. F..... ..... 95.7 volts.
Secondary E. M. F..... 13.4 "
Ratio 95.7 / 13.4 ..... 7.1
Secondary current..... ..... 2.4 amperes.

	Temp.	Primary E. M. F.	Primary Watts.	Secondary Watts.
2. Secondary open, no heat applied to core..	97.5°C.	75.6	87	0.0
4. Secondary open, heat applied to core	300 °C.	99.4	88	0.0
5. Secondary closed, no heat applied to core.	100 °C.	89.3	130	24
6. Secondary closed, heat applied to core.. ...	270 °C.	9.57	129	36.7

Data are presented in the latter part of this paper showing that it is correct to assume for small ranges that the loss in the core is proportional to the square of the primary E. M. F.

We can, therefore, deduce from Table 1 the results that would have been obtained with 90 volts as the primary E. M. F. for the four experiments.

PRIMARY, 90 VOLTS. 120.

	Temp.	Loss in core.	Primary Watts.	Secondary Watts.
2.....	97.5°C.	122	122	0.0
4.....	300 °C.	72	72	0.0
	270 °C.	*79	79	0.0
5.....	99 °C.	117	131	†24
6.....	270 °C.	80	116.7	36.7

* Estimated.
† Corrected for resistance of secondary.

The figures in Table 2 show clearly that the loss in the core is greatly diminished when its temperature is elevated, *i. e.*, when heat is applied, and that the loss in the core is practically independent of the output. The results indicate that with the secondary open and the primary at a difference of potential of 90 volts without heat applied, the core came to a temperature of 97° C. and dissipated 122 watts, then by the application of heat with the Bunsen burner,

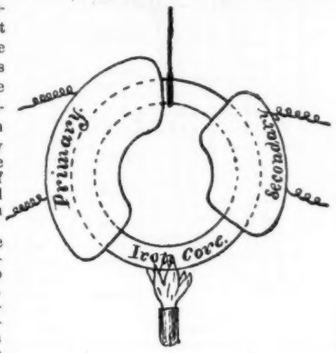


FIG. 1.

as indicated in Fig. 1, the temperature of the core was raised to 300° C. and was found to take up 72 watts. Now, if we assume the change in watts dissipated in the core to be approximately proportional to the changes in temperature that produced the same, then we see by estimation that 79 watts would have been dissipated by the core at 270° C., while 80 watts were found to have been dissipated by it at that temperature

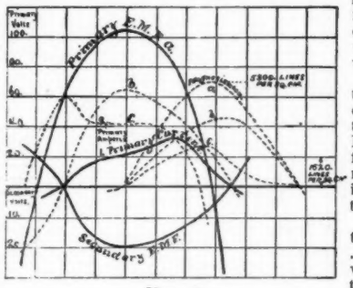


FIG. 2.

when the secondary was closed and gave an output of 32 watts.

It is perfectly plain, therefore, why we can close the secondary, take from it 32 watts, elevate the temperature of the core 170°C., and have the primary take up 5 watts less than when the secondary was open, and the core at the lower temperature.

Since the effect is due only to the fact that the core takes much less energy at higher than at lower temperatures, and since the core can dissipate energy through *Foucault current* and *hysteresis* phenomena only, it is due to a decrease of the total energy dissipated through changes in the above phenomena.

A rise of temperature in the core will increase the specific resistance, and, therefore, diminish the energy dissipated by Foucault currents. For decided degrees of magnetization, it is known that the permeability of iron increase, when it undergoes a rise of temperature. It was thought probable, therefore, that the energy

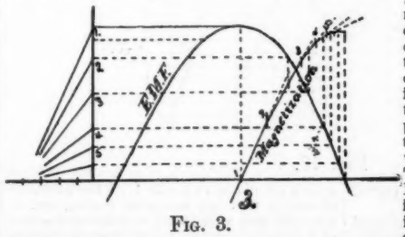


FIG. 3.

dissipated per cycle of magnetization and demagnetization would be decreased with an increase of temperature.

Experiments were made in the physical laboratory of Cornell University, by Mr. Arthur Herschel, on the hysteresis at high temperature of a cast iron ring, 12.3 cms. in diameter, that furnished a closed magnetic circuit, the length of which is 38.5 cms. The ring was wound with 30 turns of No. 8 wire cable that had a mica insulation.

The highest temperature to which the ring was subjected was 360° C.

The results of these experiments are represented graphically in Fig. 7.

One interesting thing about these results is that for degrees of magnetization below 2,000 lines per square cm., the variation of temperature below 360° C., does not change the magnetic character of the iron by an observable amount. Now, if wrought iron behaves in a similar manner, then the decrease of energy dissipated in the apparatus of Mr. Marks was not due wholly or in part to a diminution in the interests of the iron.

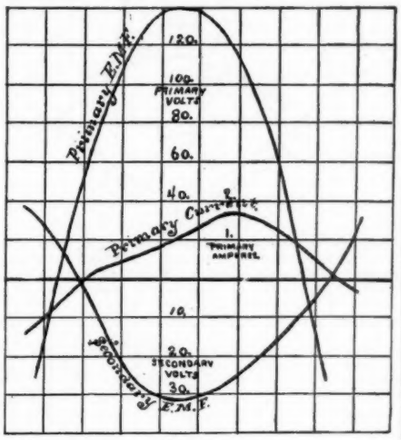


FIG. 4.

It was, therefore, due entirely to the diminution in Foucault currents, caused by the change of the resistance of the iron. A liberal estimate for the hysteresis of the core is 20 watts, whence the Foucault energy dissipated by the core at 100° C. and 90 volts was 102 watts, and at 270° C. and 90 volts it was 60 watts.

The range of temperature that produced this change was 170. The magnetization for each condition is the same, so that it is fair to assume that the E. M. F. setting up the Foucault currents is the same and that, therefore, the energy dissipated by Foucault current will diminish as the resistance of the iron is increased by the elevation of its temperature.

This gives us a rough determination for the temperature co-efficient of the iron to be .4 of one per cent. per degree centigrade, which agrees with Matthiessen's determination, and furnishes a fair check upon the conclusion just arrived at.

The second interesting feature about the performance of Mr. Marks' apparatus lies in

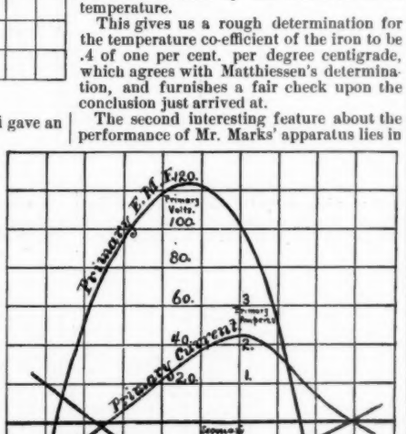


FIG. 5.

the fact that the ratio of primary to secondary turns was 3.2, while the ratio of primary to secondary E. M. F.'s varied from 4 to 8.

In this it exhibited exceedingly bad regulation so that by examination of the diagrams 2, 4, 5 and 6, we can see in exaggerated form the trouble it is so hard to become rid of in transformers to be used for incandescent lighting. Any one of these diagrams shows that a large portion of the lines of magnetization that was set up about the primary were not set up about the secondary. That is to say, the counter E. M. F. that is produced in the primary is due to the magnetization through it that also took place through the secondary, plus the variation of magnetizaton that was set up in its own air space, and that leaked by the secondary through the air. When the transformer furnishes current, this difference becomes greater and greater because of the increased current in the primary and the setting up of a counter magnetization by the

(*Continued on page 10.*)

ELECTRIC LIGHT NEWS

—— A very successful electrical exhibit was held last week in the lecture room of the Brooklyn Institute.

—— The Edison General Electric Company has declared the third quarterly dividend of two per cent., payable July 3.

—— The Quincy, Ill., Gas Light and Coke Company will unite with the Thomson-Houston Electric Light and Power Company, of that place.

—— Improvements have been begun by the Evansville, Ind., Gas and Electric Light Company, which will increase the value of their electrical plant by $100,000.

—— During the past week eight patents for new inventions were granted to Thomas A. Edison, Llewellyn Park, N. J. Two are for a phonogram blank, three relate to the phonogram, two to the magnetic separator, and one for a voltaic battery.

—— The streets of Rockville, Ind., are shortly to be lighted by the Westinghouse alternate current arc light system. A plant of 50 lights has already been contracted for, and the installation of the machinery is to be immediately commenced.

—— The men that change the carbons in the electric lamps at Freemont, O., say that each morning they find the globes three-fourths full of June bugs, that, dazzled by the light, were attracted and trapped. The dead bugs are scooped out, but the following morning the men find the globes half full again.

—— Mayor Davidson, of Baltimore, has settled the fate of the electric light ordinance by announcing that he will not sign it. This means that the present arrangement with the Brush Company will be maintained until the passage of another ordinance by the city council, which will not meet again until October 20. No contract exists with the Brush Company, but the city is being lighted by it from day to day at 40 cents a lamp.

—— Not long ago the Westinghouse Electric Company installed its alternate current apparatus in Salt Lake City, Utah, and now the report has been made that another town in the Mormon State is about to establish an electric light plant within its precincts. A company has lately be organized in Ogden, Utah, and the Westinghouse Electric Company is going to install alternate current apparatus for a central station plant of 1,500 incandescent and 80 arc lights.

—— The Newark, N. J., Electric Light and Power Company is to have another power station, and has purchased 240 feet of river front for the purpose. The property lies north of and adjoins the city wharf. This company has paid out a large share of its profits for hauling coal into Mechanic street, and a great saving will now be made by having coal delivered directly at the works by boat and rail. The Mechanic street station will continue in operation, however, and a 300 horse-power engine will be put in at the new station.

—— An ingenious invention of Herman Lemp, the electrician of the Thomson Electric Welding Company, recently patented, is a transformer for heavy currents, in which the primary is enclosed in the secondary, by means of which great volume is secured by low electromotive force. There is thus obtained a large output for a given amount of copper. Another invention is a sliding clamp for electric welding machines. The clamps which hold the article to be welded have to slide toward each other to take up the weld, and if, when welding copper and some other metals, the clamps should bind, it would break the current. This danger has been obviated by placing the clamp upon copper rollers, in a V-shaped bed, thus obtaining the desired result with the least possible amount of friction.

ALTERNATING CURRENT APPARATUS.

(*Continued from page 9.*)

secondary current in its own air space that still further reduces the magnetization through it.

Fig. 1. shows the primary disposed on one side and the secondary on the other side of the annular core. The insulation was produced by thick asbestos paper that produced large air spaces between the turns, in which magnetization was produced.

In Fig. 2, E. M. F. curve *b* is the center E. M. F. in the primary produced by the magnetization through it that also took place through the secondary, and which is obtained by multiplying the secondary E. M. F. by 3.2, the ratio of the turns. E. M. F. *c* is the curve of counter E. M. F. *c* in the primary that was produced by magnetization through the primary that did not take place through the secondary. This is obtained by subtracting E. M. F. *b* from E. M. F. *a*. E. M. F. is seen to be approximately proportional to the rate of change of the primary current which suggests magnetization that is set up through the primary that is proportional to the primary current, or that which is set up in the air, or in a magnetic circuit compounded of iron and air.

In the same figure the curves of magnetization *a* and *b* are obtained graphically from the curves of E. M. F. *a* and *b*, by the method shown in Fig. 3.

This method is found to be fully as accurate and requires much less time and is more simplified than the analytic method making use of Fourier's theorem. By subtracting *b* from *a* we obtain *c*, the curve of magnetization that was produced through the primary and not through the secondary. This curve of magnetization *c*, is seen by the diagram to be of about the same form as the current curve, but to lag behind the latter which indicates that it was magnetization that was produced through air and air and iron.

During the discussion at a recent meeting of the Institute, the question was asked whether measurements of Foucault currents and hysteresis as separated from each other had ever been made.

There can be no doubt but that we have separate determinations of those quantities when we have determined the energy dissipated in a magnetic circuit of iron, by rapid cycles of magnetization and demagnetization and the energy dissipated by static hysteresis for the same rapidity and degree of magnetic changes as determined from a Ewing card observed through slow magnetization and demagnetization.

Diagrams 8 and 9, are two good illustrations of such determinations.

In diagram 8, the outer card represents the card obtained from the existing current and magnetization curves taken carefully at 138, from the 10-light transformer upon which the tests were made that were communicated to the Institute by the writer at the last December meeting. The inner card drawn in a full line in Fig. 8, is the Ewing card of static hysteresis. This transformer on being taken apart was found to have its disks insulated with paper so that the statement made by the writer in December, with regard to the lamination of the transformer, was erroneous in this particular. Foucault currents should therefore be found to be quite absent, as the diagram in Fig. 8 indicates. A study of these cards does not reveal that which can be recognized as a trace of viscous hysteresis and they differ only by an amount of Foucault current energy that is represented by a small current lagging approximately an eighth of a period behind the primary impressed E. M. F.

In Fig. 9, the outer card is deducted from the current and magnetization curves that are represented in diagram 12. These curves were obtained with 195 per second from a cast iron ring, 8.6 cms. in diameter and 2.7 sq. cms. in cross section, wound with 200 turns of wire that had a negligible resistance.

In Fig. 9, the inner card is the card of static hysteresis.

In diagram 12, the lower broken current curve is that of the exciting current curve drawn in from the inner card of Fig. 9. By subtracting this current from the one that was observed we obtain the upper broken current curve, which is the current that exists to supply the Foucault current energy in the core. The point to be noticed from the two extreme cases here taken up, is that in each case the curve of current supplying the Foucault current energy is about one-eighth of a period behind the impressed E. M. F.

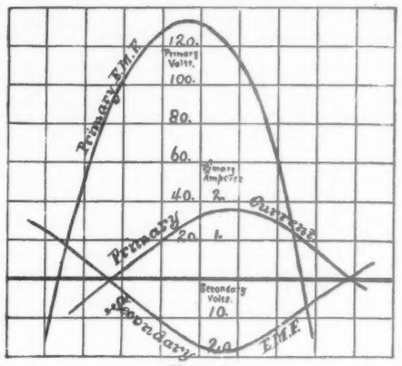


Fig. 6.

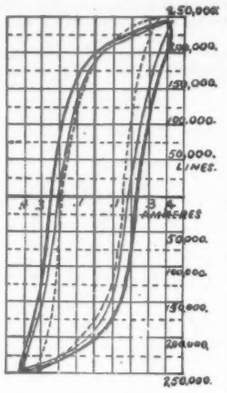


Fig. 8.

In diagram 13, Messrs. Fortenbaugh & Sawyer, students in Electrical Engineering at Cornell University, made determinations, the results of which are given in Table 4, of the amounts of energy that are taken up per cu. cm. in wrought iron wire cores, of different degrees of lamination, at various degrees of magnetization, and at different periodicities in which the oxydized surface of the iron was depended upon for insulation. They made use of four iron wire rings the mean diameter of which was 8.9 cms. and on each of which were wound 200 turns of wire that had a negligible resistance.

Diagrams 11 and 13 are given for illustrating the extreme variation in the character of the exciting current in going from the lowest to the highest degrees of magnetization.

Coil of wire B. & S. G.	Area of coil sq. cms.	Periodicity.	Magnetization per sq. cm.	Loss watts per cu. cm.
1.....12	5	169	5,300	.18
2.....12	5	177	8,560	.46
3.....12	5	177	11,130	.75
4.....16	4.9	173	6,000	.14
5.....16	4.9	175	9,450	.33
6.....16	4.9	167	10,930	.43
7.....16	4.9	93	7,250	.10
8.....16	4.9	92	13,360	.41
9.....16	4.9	45	13,000	.10
10.....24	3.56	175	8,150	.19
11.....24	3.56	53	8,750	.12
12.....36	3.14	173	9,300	.16
13.....36	3.14	173	14,900	.29
14.....36	3.14	173	18,000 app.	.46
15.....36	3.14	96	10,700	.15
16.....36	3.14	92	17,800	.33
17.....36	3.14	47	18,000 app.	.13
18.....36	2.7	160	4,990	1.50

Cast iron ; diameter, 3.5x2.54.

The results show, on account of the presence of Foucault currents to a larger extent for the higher degrees of magnetization, a variation in losses as the square of the periodicity and the square of the magnetization. The results obtained with the several cores at the periodicity of 175 have been plotted in diagram 14.

The core of No. 36 wire agrees closely with Ewing's determination of static hysteresis for moderately soft wrought iron, and is, therefore, entirely free from Foucault currents. It is interesting to note that for the cores of Nos. 36, 24 and 16, there is but little difference in the losses for degrees of magnetization below 4,000 lines per centimetre.

Likewise that for the higher degrees of magnetization it is seen that the loss is proportional to the magnetization, as Ewing's results on static hysteresis, given in Fig. 10, indicate they should be.

Diagram 13 shows the effect of compelling the magnetization to be carried above the bend of the characteristic curve of the iron.

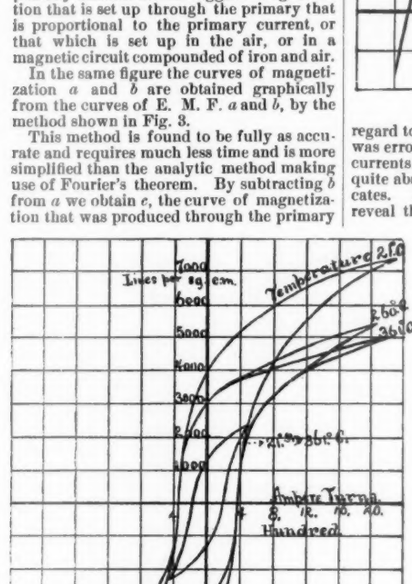


Fig. 7.

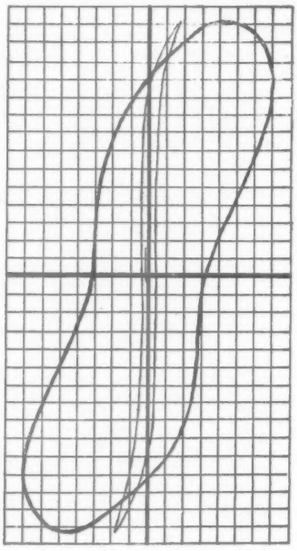


Fig. 9

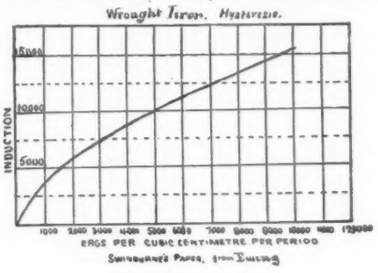


Fig. 10.

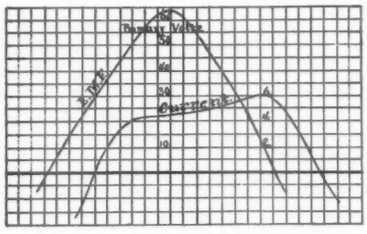


Fig. 11.

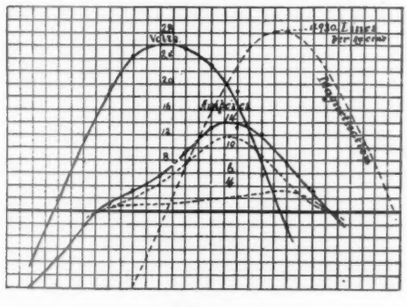


Fig. 12.

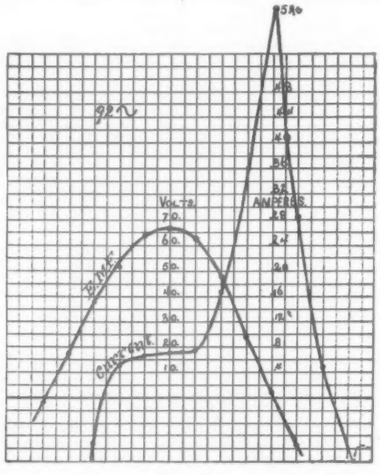


Fig. 13.

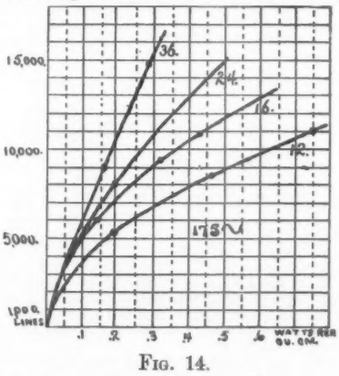


Fig. 14.

Sibley College,
Cornell University, June 14, 1890.

—— The biggest fool out late is the man who climbs an electric street car pole to light his cigar. They have that kind in some cities. We'll have 'em here after a while—that is to say, the poles.—*Cairo, Ills., Bulletin.*

Efficiency of the Transformer.

BY CALVIN HUMPHREY AND WILLIAM H. POWELL, READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, JUNE 17, 1890.

In pursuing this particular line of investigation, it has been our endeavor to throw some light, if possible, upon the general subject of transformers and upon the action of iron when magnetized and demagnetized by an alternating current of high periodicity.

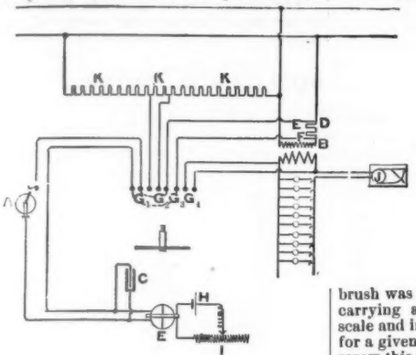


FIG. 1.

And in order that the results obtained might have a practical bearing, the conditions of working were made to conform as closely as possible to the conditions under which transformer systems are operated in this country.

The question of the economy of the commercial converter as a transformer of energy has been frequently taken up, both from practical and theoretical standpoints, but with widely varying and conflicting results. The losses in the transformer of the closed circuit type have been considered large and inevitable—so much so in fact that Mr. Swinburne has introduced in England a new form of open circuit transformer known as the "Hedgehog." It has been Mr. Swinburne's endeavor to obviate the dissipation of energy in hysteresis and Foucault currents in a part of the magnetic circuit, by having that circuit closed through air. But, as will be seen later, the perfection of the transformer is to be met in a better grade of iron, rather than in any radical change in design.

The results presented in this paper are of especial interest as being supplementary to the work of Professor Ryan and Mr. Merritt in the same line, which was presented to the Institute last December. The 10-light transformer which they tested was found to have a remarkably heavy loss on open circuit, which was shown to be due almost entirely to hysteresis in the iron. The transformer gave an efficiency of 86 per cent. at normal load and an "all day" efficiency of about 40 per cent.

In our work on a 40-light transformer of the same design, the two coils placed side by side in a core of laminated plates (see Fig. 1) but of more recent manufacture, the loss on the open circuit was found to be about one-half as great as in the 10-light transformer. Its efficiency reached 96.2 per cent. at normal load, and the "all day" efficiency would be about 90 per cent.

The method employed in the work is substantially Prof. Ryan's method. The instantaneous values were obtained by means of a commutating device attached to the alternator. This device consisted of a wooden disk, mounted rigidly on the shaft of the alternator, with a steel contact at one point in its periphery, which made contact with a small piano wire brush once every revolution. The holder carrying the piano wire brush was attached to a second wooden disk carrying a pointer which moved over a scale and indicated the position of the brush for a given reading. By means of a clamp screw this second wooden disk carrying the brush and pointer could be conveniently set at any point. Now, since the steel contact in the wooden disk is fixed relatively to the armature, it must share the ever varying E. M. F. of the armature. Then, evidently, if the brush which completes the circuit through the contact be altered in position, values can be obtained for different points on the curves of E. M. F. and current.

The Ryan quadrant electrometer was used to measure the primary E. M. F., secondary E. M. F. and primary current. A condenser was connected in multiple with the electrometer. The primary current was measured by the fall of potential through incandescent lamps placed in series with the primary of the transformer. These lamps were carefully calibrated with the standard instruments of the laboratory, in order to know their resistance at different temperatures. Then, knowing the resistance of the lamps and the potential difference at their terminals, the current flowing at once becomes known.

To measure the primary E. M. F., twenty-two 50-volt lamps were placed in series across the primaries. The electrometer was connected around two of these lamps, and the whole number calibrated in order to know just what part of the total impressed E. M. F. was measured. The secondary E. M. F. was measured direct. The secondary current was measured by means of an electro-dynamometer, which was carefully calibrated both before and after the experiments, and was found to be constant. The commutating device was placed in series with the electrometer. Wires were run from the terminals from which measurements were desired, to a convenient switchboard.

In obtaining the Ewing card of hysteresis of the iron core of the transformer, current from a storage battery was sent through the secondary circuit, and the magnetization set up in the core was measured by the *kick* on a ballistic galvanometer in the primary circuit. The current in the secondary was gradually increased until the intensity of magnetization corresponded with the maximum magnetic density of the transformers when working on a 1,000-volt circuit. The current was then decreased gradually until zero was reached. It was then reversed and the method continued until a complete cycle of magnetization had been covered.

It is worthy of mention that this method, which gives something so definite and fundamental in the treatment of the alternating current, has only come into use within the past year, and the task of getting true instantaneous values of the complete waves of E. M. F. and current which has always been considered too tedious for ordinary patience to deal with, was accomplished with ease in this work in 45 minutes. A calibrated scale for the electrometer readings added very much to the facility with which observations could be taken.

The marked improvement of the 40-light transformer over the 10-light is due, we believe, to an improvement in the magnetic properties of the iron and a fewer number of turns in the coils, made possible by the better grade of iron.

In the 10 light transformer, Foucault currents were very effectually weeded out by the interposition of sheets of paper between the laminated sheets of iron in the 40-light, the oxide of iron on the surface of the plates was the only safeguard against Foucault currents.

The form and extent of the open circuit curves show the loss due to hysteresis and the slight loss also due to Foucault currents.

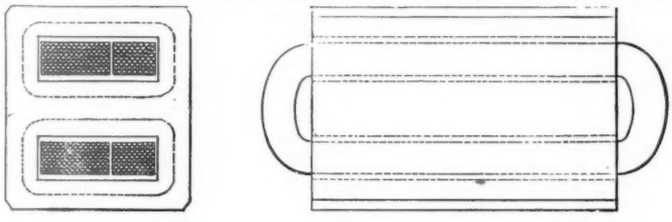
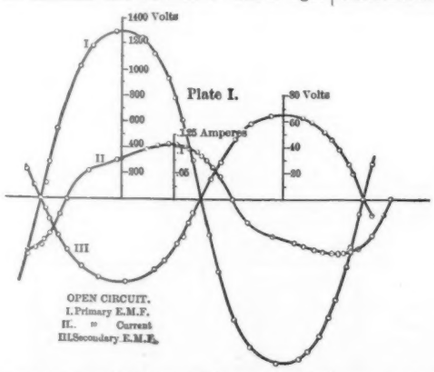
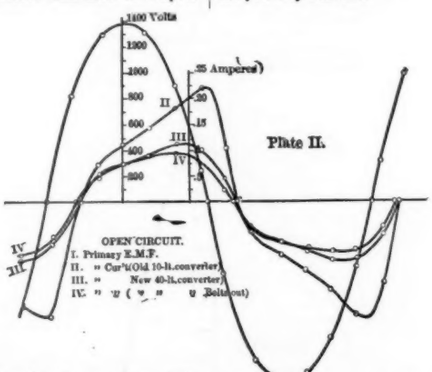
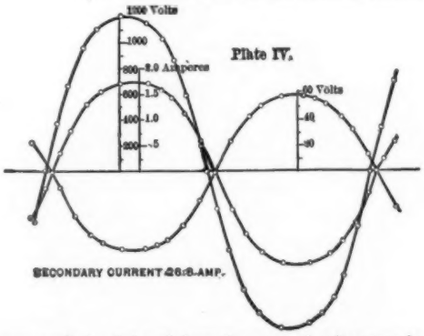


FIG. 2.

The presence of Foucault currents is indicated by the fact that the maximum of the primary current wave does not occur simultaneously with the zero of primary E. M. F., but a little before. It is found upon analysis of the primary current curve into its elements, hysteresis and Foucault currents (see Plate XIII), that the Foucault current component occurs 120 in advance of the theoretical magnetization curve, and not 90 in advance, as has generally been assumed. Therefore, when superimposed upon the hysteresis curve, it introduces a component in advance, and thereby decreases the lag of the primary current.

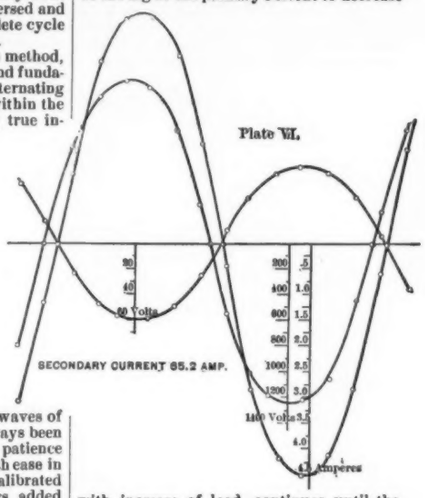






The primary current curve was again taken with the laminated plates loose and free to vibrate. The loss was about 10 per cent. less than in the former case (Plate II). This is thought to be brought about by the decrease in the hysteresis loss, due to the increased mechanical shock, arising from the free vibration of the plates. The vibration *was* very perceptibly increased. The curve obtained is more regular in form, indicating less hysteresis loss.

The lag of the primary current behind the primary E. M. F. is seen to be greatest when the secondary circuit was open, and decreases as a non-inductive load is introduced into the secondary circuit. This tendency of the lag of the primary current to decrease with increase of load, continues until the curve of primary current comes into unison with the curve of secondary E. M. F.



The secondary E. M. F. is in unison with the primary E. M. F. on open circuit, and gradually falls behind as the load increases on the secondary. This is doubtless due to the leakage of lines of force arising from the enormous magnetizing forces at work in opposition to one another in the primary and secondary circuits.

When an inductive resistance is introduced into the secondary circuit, the lag of the primary current is greatly increased, as shown by the set of curves in Plate X. The inductive resistance used in this case was due to a small alternating current motor. The curve of secondary current was also taken and found to lag behind the secondary E. M. F., and to be in unison with the primary current. About 5.5 amperes flowed in the secondary, and yet the lag of primary current is as great as on open circuit.

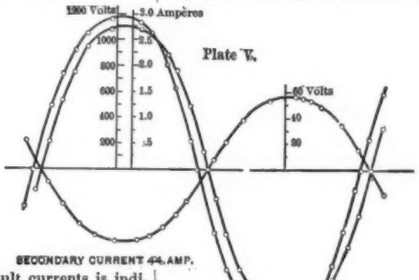


Plate XI shows the relation of primary current and primary E. M. F. when the secondary was closed through the secondary of a 20-light transformer whose primary remained open. The current curve shows a distinctive lag from the inductive resistance and is altered in form to a great extent.

The outside loop in Plate XII is the loop of total loss hysteresis and Foucault current —deduced from the open circuit curves in the following manner. The current which flows to maintain the counter E. M. F. of the transformer on open circuit obviously includes the losses due to Foucault currents and hysteresis. If, then, a magnetization curve whose maximum has been computed, be drawn in 90° behind the curve of primary E. M. F. and of the same form—since it is a function of the E. M. F.—and a curve be plotted using ordinates of primary current as abscissæ, and corresponding values of lines of force from the theoretical magnetiza-

tion curve, as ordinates, the outside loop in Plate XI is obtained.

The inside loop is the ordinary Ewing card of hysteresis loss found by carrying the iron slowly through a complete cycle of magnetization. The lines of force were computed from the *kick* on a ballistic galvanometer. This card has on it no Foucault current effects. If, then, we reverse the above method, and from the Ewing card and the magnetization curve deduce a primary current curve, we shall have a curve representing hysteresis (for this iron) loss.

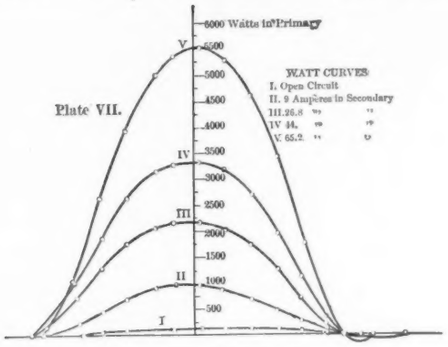
This was done, and it is of especial interest to note that the form of curve obtained in this manner is identical with the open circuit curve of the 10-light transformer in which Foucault currents were suppressed by the interposition of sheets of paper (see curve III, Plate XIII). Having then two curves fitted to the same scale, one representing total loss and the other hysteresis loss, if we subtract ordinates of the latter from corresponding ordinates of the former, a curve representing the opponent due to Foucault currents will be obtained (curve IV, Plate XIII). It was in this manner that the analysis before referred to was made. The position of the Foucault current component accounts for the round corners in the outside loop of Plate XII.

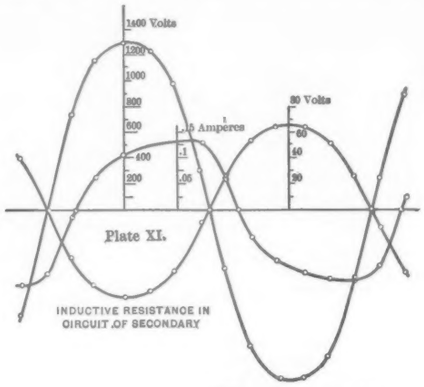
From Plate IX will be seen the Watt curve for open circuit loss, one for 990 volts and the other for 740 volts. From the value of the mean ordinates it is seen that the loss varies strictly as the square of the impressed E. M. F.

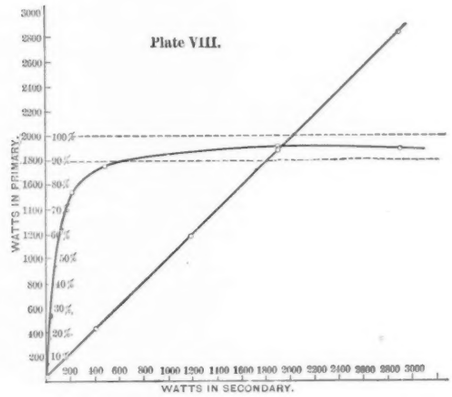
In Plate II is plotted to the same scale the current which flowed on open circuit in case of the 10-light transformer and the 40-light transformer.

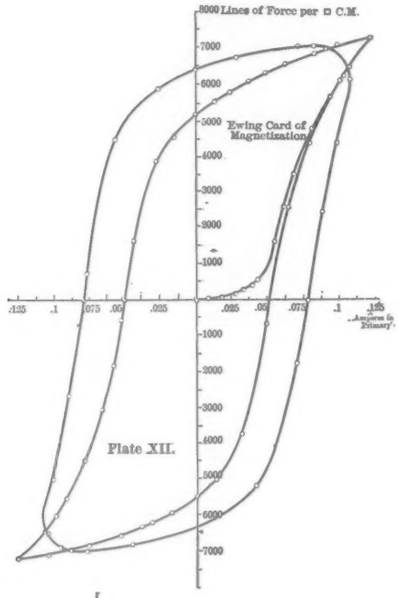
Plates IV, V and VI, show the curves of primary E. M. F. and current and secondary E. M. F. for different loads, from which the Watt curves of Plate VII are computed by taking the product of corresponding ordinates of primary E. M. F. and current.

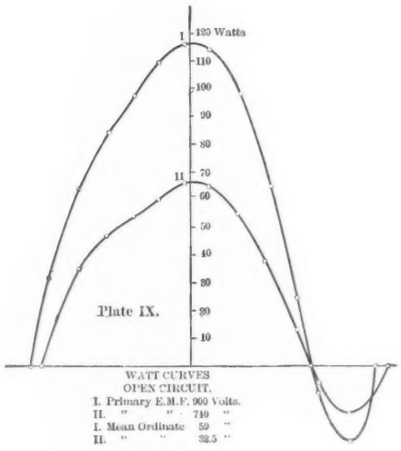
The efficiency curve shown in Plate VIII is the ratio between the energy of the primary circuit as indicated by the mean

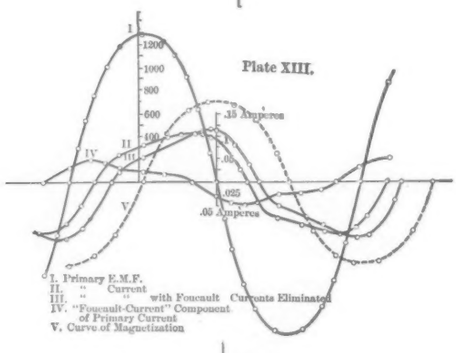


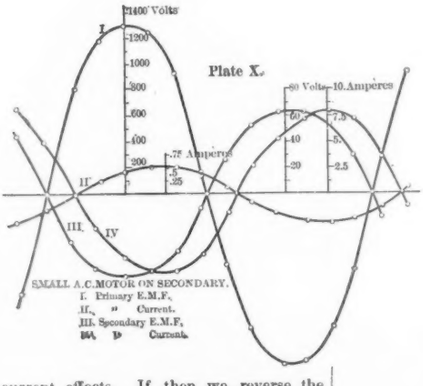


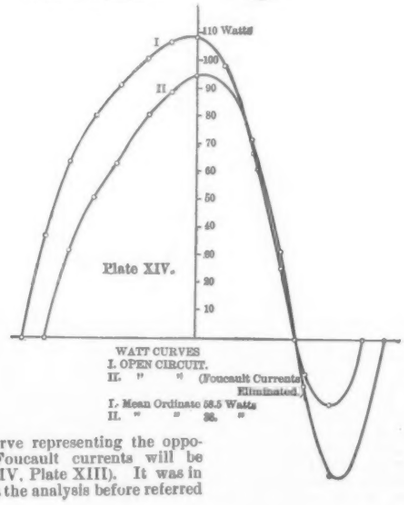












OPEN CIRCUIT, PLATE I.

BRUSH.	S. E. M. F.	P. E. M. F.	P. C.
18.5	21. Volts.	450 Volts.	.104 Amperes.
18.2	9.	190	.102
18.	0.	0	.096
17.8	9.	190	.084
17.6	16.5	310	.074
17.3	28.	545	.036
17.	39.	760	0±
16.5	51.5	1020	.02±
16.	59.	1170	.056
15.	65.	1285	.074
14.	61.5	1223	.094
13.5	57.	1130	.102
13.	47.	925	.104
12.7	40.	780	.104
12.4	27.5	565	.102
12.2	20.	330	.098
12.	9.	245	.096
11.8	0.±	70	.088
11.6	0.±	0	.078
11.3	14.	300	.056
11.	27.5	560	.046
10.5	44.	890	0
10.	56.	1105	.03
9.	63.5	1265	.072
8.	63.5	1285	.09
7.5	60.5	1215	.098
7.	53.5	1085	.104
6.7	47.5	945	.110
6.4	40.	810	.110
6.2	29.	610	.108
6.	26.	545	.106
5.8	18.	385	.104
5.5	0 +	110	.078
5.	14.	260	.074

PLATE II.

Open Circuit (Old 10-lt Converter.) (40-lt Converter. Bolts Out.)

BRUSH.	P. E. M. F.	P. C.	BRUSH.	P. E. M. F.	P. C.
19	825	.196	20	775	.098
18	0	.225	18	0	.089
17	840	.042	17	845	.0
16	1320	.075	16	1245	.048
15	1420	.117	15	1355	.074
14	1345	.143	14	1290	.09
13	1010	.18	13	965	.09
12	230	.22	12	235	.074
11	630	.1	11	590	.0
10	1115	.058	10	1140	.043
9	1395	.1	9	1325	.074
8	1420	.13	8	1312	.09
7	1195	.17	7	1103	.1
6	570	.217	6	520	.1
5	300	.18	5	318	.058
4	1060	0	4	1014	0

PLATE III.

OPEN CIRCUIT, LOW E. M. F.

BRUSH.	S. E. M. F.	P. E. M. F.	P. C.
19	24.5	595	.07
18	0.	0	.065
17	27.5	580	0
16	42.	870	.04
15	47.	965	.055
14	45.	950	.07
13	33.	715	.075
12	8.	180	.07
11	19.	420	.04
10	39.	835	.0+
9	43.	960	.065
8	46.	945	.07
7	38.	810	.075
6	16.5	395	.07
5	8.	210	.05
4	35.5	755	0

PLATE IV.

SECONDARY CURRENT, 26.8 AMP.

BRUSH.	S. E. M. F.	P. E. M. F.	P. C.
18.5	24.5	370	.82
18.	0.	0	.22
17.5	11.	410	.28
17.	30.5	743	.86
16.5	46.	980	1.25
16.	53.	1110	1.55
15.	59.5	1220	1.76
14.	57.5	1145	1.74
13.5	54.	1045	1.64
13.	47.	830	1.43
12.5	34.	565	1.06
12.	13.	200	.16
11.	21.	375	.58
10.5	37.	850	1.06
10.	47.5	1060	1.44
9.	58.5	1215	1.77
8.	59.5	1195	1.80
7.5	56.	1115	1.66
7.	52.5	968	1.58
6.5	42.	780	1.32
6.	27.	390	.9
5.5	10.	0	.34
5.	0.	325	.16

ordinate of the Watt curve, and the energy of the secondary circuit as expressed by the product of the $\sqrt{\text{mean}^2}$ readings for E.M.F. and current over. The coercive force is equal to 0.8 C. G. S.

These considerations go to show that the loss due to the reversal of polarity of the iron, which perhaps must always be present, may be reduced almost indefinitely by a proper study of the magnetic properties of the iron used.

The Watt curves in Plate XIV show the relation between the total loss on open circuit and the loss if Foucault currents were eliminated.

PLATE V.

SECONDARY CURRENT, 44 AMP.

BRUSH	S. E. M. F.	P. E. M. F.	P. C.
19.	22.5	300	1.9
18.	0.	0	.37
17.5	10.	465	.525
17.	26.	745	1.3
16.5	39.	935	1.93
16.	48.5	1075	2.4
15.	55.5	1185	2.77
14.	56.	1150	2.67
13.5	51.	1060	2.58
13.	49.	835	2.3
12.5	47.	625	1.9
12.	35.5	230	1.13
11.5	21.	100	.32
11.	0.	503	.48
10.5	11.	795	1.3
10.	24.5	1015	1.98
9.	40.	1140	2.6
8.	54.	1200	2.84
7.5	57.5	1105	2.77
7.	55.5	1030	2.67
6.5	51.5	805	2.23
6.	45.5	510	1.69
5.5	30.5	130	.97
5.	17.	250	0.

PLATE VI.

SECONDARY CURRENT, 65.2 AMP.

BRUSH.	S. E. M. F.	P. E. M. F.	P. C.
19.	45.	745	3.
18.	14.	0	1.08
17.	21.	730	1.23
16.	47.	1120	3.45
15.	58.	1245	4.3
14.	60.	1195	4.35
13.	51.	905	3.8
12.	26.	240	1.85
11.	8.	550	.4
10.	40.	1050	2.9
9.	55.	1225	4.1
8.	59.	1235	4.5
7.	55.	1070	4.25
6.	37.	475	2.83
5.	0.	235	0.
4.	29.	900	2.

PLATE VII. WATT CURVES.

AMPERES IN SECONDARY

Open-Cir.	9	26.8	44.	65.2	Brush.
—22.1	0	0	180	0	18.
—7.6	148	630	960	1020	17.
30.6	400	1230	1750	2650	16.5
63.8	695	1720	2600	3860	16.
82.	880	2040	3080	4880	15.5
96.	970	2130	3250	5350	15.
105.	960	2160	3300	5580	14.5
116.	850	2020	3170	5250	14.
113.	700	1715	2700	4600	13.5
96.5	480	1220	1950	3440	13.
65.	250	600	1070	1800	12.5
22.8	30	115	253	443	12.
—10.5	0	0	—350	—96	11.5
—25.2		319	2500	220	11.

PLATE IX.

WATT CURVES. OPEN CIRCUIT.

No.	990 VOLTS.	740 VOLTS.
16.9	0.	
16.7		0.
16.5	30.5 Watts.	11.5
16.	64.	34.
15.5	82.	46.5
15.	96.	53.5
14.5	111.5	61.
14.	116.	66.
13.5	113.5	64.
13.	97.	54.
12.5	65.	35.5
12.	23.	12.5
11.7	0.	0.
11.5	—10.5	—7.5
11.	—25.	—17.
10.5	0.	7.
10.3		0.

PLATE X.

SMALL ALTERNATING CURRENT MOTOR ON SECONDARY.

BRUSH.	S. E. M. F.	P. E. M. F.	P. C.	S. C.
19	30.	780	.53	7.36
18	0.	0	.35	4.48
17	40.	790	0	0.
16	60.	1195	.25	3.52
15	64.	1310	.43	6.2
14	61.	1240	.53	7.5
13	46.	930	.54	7.5
12	11.	240	.42	5.76
11	26.	570	.12	0.
10	55.	1115	.14	2.89
9	63.5	1305	.375	4.47
8	63.5	1310	.50	7.20
7	53.	1095	.55	8.32
6	27.5	560	.49	7.20
5	14.	290	.25	3.52
4	47.	950	.0	0.

PLATE XI.

INDUCTIVE RESISTANCE OF SECONDARY.

BRUSH.	S. E. M. F.	P. E. M. F.	P. C.
19	39.	790	.147
18	0.	0	.126
17	40.	770	0
16	61.	1185	.066
15	67.	1310	.108
14	63.5	1245	.126
13	48.5	950	.135
12	11.	290	.135
11	26.	515	.06
10	56.	1105	.05
9	66.	1315	.099
8	65.5	1295	.12
7	56.	1105	.126
6	26.	545	.126
5	14.	260	.108
4	48.	930	0

PLATE XII. EWING CARD.

No.	P. Current.	C. G. S. Lines per □ c. m.	No.	P. Current.	C. G. S. Lines per □ c. m.
1	.01	36	24	—.025	4445
2	.02	96	25	—.027	3828
3	.03	180	26	—.042	1600
4	.035	246	27	—.05	450
5	.04	312	28	—.058	1890
6	.045	420	29	—.067	3020
7	.053	635	30	—.078	4425
8	.058	1630	31	—.09	5565
9	.063	2548	32	—.095	6005
10	.07	3515	33	—.103	6615
11	.083	4775	34	—.12	7200
12	.095	5645	35	—.103	7125
13	.105	6312	36	—.085	7028
14	.11	6635	37	—.07	6812
15	.12	7120	38	—.05	6615
16	.102	7075	39	—.037	6410
17	.087	6880	40	—.03	6270
18	.063	6555	41	—.015	6095
19	.05	6350	42	0	5665
20	.04	6180	43	.033	3820
21	.027	5892	44	.067	2550
22	.015	5644	45	.103	6240
23	.0	5124	46	.12	7005

Measurements of Uniform Magnetic Fields by Means of the Transverse Stress, and on the Permeability of Manganese Steel.

A wire of manganese steel, about 70 centimetres in length, was annealed by heating it to redness in an atmosphere of hydrogen for about half an hour, and allowing it to cool slowly. It was then placed in a fine glass tube to keep it from bending, and suspended in a pair of silk slings depending from a horizontal rod, in such a manner that one end of the wire was within, and the other without, the field. When the field was developed the wire was drawn into it with a force proportional to the permeability of the material of the wire and to the square of the strength of the field. The amount of this force was calculated from the weight of the wire, its perpendicular distance from the rod from which it was suspended, and its displacement, which latter was read off by means of a Quincke kathetometer microscope.

It was found impossible to get exactly the same results from any two wires, even if taken from the same piece, and a different displacement was obtained by simply turning the wire end for end, so that the permeability was variable from point to point, which the author believes to be due to variations in physical condition, and in the chemical combination between the iron and the manganese. The effect of annealing was generally, but by no means invariably, to increase the permeability. The permeability was also found to be much greater for fine wires than for thick ones. Moreover, for a given strength of field it was increased by diminishing the size of the poles of the magnet producing the field, and by diminishing the distance separating them.

On account of these variations it is necessary to calibrate each wire in fields of known strength. The author then draws a curve in which the abscissæ are the strengths of the field, and the ordinates the corresponding transverse stresses, and then determines the strength of an unknown field from the calculated transverse stress by interpolation. For accurate measurements the calibration must be made with poles of the same shape and distance apart as those which give rise to the field which is to be investigated, but the error introduced by varying the size and distance apart of the poles does not exceed 5 per cent. of the strength of the field.—*Elektrotechnische Zeitschrift.*

It has been decided by the management of the Spring Garden Avenue Street Car Line, of Pittsburgh, to turn the latter into an electric road. The line is being operated by the Allegheny Traction Company and is part of the old Transverse line. The proposed change in motive power has been discussed considerably by the directors, who are all in favor of it.

ELECTRIC CLUBS.

NEWS FROM DISTANT CLUBS—PERSONAL MENTION.

Harvard Electric Club.

Like other Harvard Organizations, the Electric Club has adjourned for the Summer vacation, and its members are scattered far and wide. At the last meeting the annual election of officers was held. There were two or more candidates for almost every office, and some rather close contests resulted. The names of the fortunate ones appeared in the REVIEW of June 7th.

The Members of the Club have reason to be pleased with the record of the first year. Two public lectures have been given, the first by Professor Trowbridge, and the second by Capt. Griffin. Besides these there have been two lectures for members only, one given by Mr. C. H. Davis, and the other by Mr. J. C. Wait. A very enjoyable feature of the Club has consisted of trips made to different places of interest. Among these trips were visits to the central stations of the Boston Electric Light Company and of the Edison Company, to the factories of the Thomson-Houston Company and Thomson Electric Welding Company, and to the Cambridge Electric Light Company's station.

The Club has maintained a reading room where the chief electrical papers may be found. There is also a large collection of catalogues of electrical apparatus of all kinds.

Next Year the features which have proved so successful will be again prominent. A series of six or eight public lectures by eminent men will probably be given, and there will be numerous visits to places of interest. In short, the Club will try to continue to deserve the compliment paid it by an outsider who was looking at the poster for Capt. Griffin's lecture some time ago. "There's only five or six live clubs at Harvard, and I guess the *Electric* is one of them."

Atlanta Electric Club.

In a Communication "dictated to and transcribed from the phonograph-graphophone," Mr. F. E. Clarkson, chairman of the board of managers, has the following to say: "The Atlanta Electric Club is now an assured fact. It starts out with a charter membership of 40, and at present the board of managers have 10 new applications for membership. The Club rooms are very neatly and tastefully furnished, and beautifully lighted by a novel arrangement of incandescent light donated by the Thomson-Houston Company. The rooms are connected by telegraph with the Postal Telegraph Company and the Western Union; we also have call boxes, telephones, phonographs and phonograph-graphophones. The lecture hall is supplied with a fine pool and billiard table, and everything is well arranged for the best comfort of the members and their out of town guests."

Kansas City Electrical Society.

Notwithstanding the extreme heat, a large and enthusiastic number of electricians attended the regular meeting of the Kansas City Electrical Society, in the Wales building, last week. The principal subject discussed was "Strong Current Protectors and Lightning Arresters." Mr. Barron, Mr. Smith and Mr. Johnston, speaking at some length.

New York Electric Club.

Gen. O. E. Madden, President of the Electric Club, returned from a four months' trip abroad, Friday morning of last week. Messrs. H. L. Storke, Dexter Smith and Chas. W. Price, met him at Quarantine at the attractive hour of 4.30 A.M., and gave welcome news from home. Mrs. Madden and numerous friends welcomed the traveler at the Hoboken pier, where his steamer, the "Lahn," unloaded. Gen. Madden is looking extremely well, and has enjoyed every minute of his travels, that dread of all ocean voyagers, *mal de mer*, fleeing before his genial presence.

KINDRED INTERESTS

The A. B. C. Motor Company, 44 Gold street, city, report an increasing sale of their motors. They make a little motor with fan attachment which is in great demand.

The Thomson-Houston Motor Company has established a New York office at 115 Broadway, with Mr. Sherwood in charge and Mr. Howard Wheeler as assistant.

The Electro-Pneumatic Time Company, 45 Broadway, have equipped the Aldrich Court office building with their time system, and have several other large contracts in prospect.

The Sprague Electric Railway and Motor Company, of this city, has been awarded the contract for equipping the Naumkeag Street Railway with electric power. The price is over $300,000.

Edwards & Company, Fourth avenue and 144th street, are just putting upon the market a neat little push button, an ingenious door opener, and a programme clock which ought to meet with ready sale.

Messrs. J. A. Grant & Company, the Boston agents of the McIntosh-Seymour Company, Auburn, N. Y., have secured a contract for the entire steam equipment necessary for operating the new electric light and power station which the Thomson-Houston Electric Company is about to install at Kingston, Jamaica.

The Fort Wayne Electric Company, through Mr. C. S. Knight, has just closed a contract with the United Gas Improvement Company, of Philadelphia, for 600 new Wood arc lights, to be operated in connection with their gas plant at Kansas City, Mo. The New York office has closed a contract with the Raritan Electric Light and Power Company, Perth Amboy, N. J., for a 600-light Slattery alternating incandescent plant.

The Lane & Bodley Company, of Cincinnati, have this week closed contracts with the Cincinnati Street Railway Company for two 28x60 and one 24x60 Corliss engines; also have sold a 22x48 to the Henry Pearce's Sons' Cotton Works; an 18x42 to the Walworth Electric Light Company, of Boston, Mass.; and a 20x48 Corliss engine for the Main Street Electric Railway Company, Cincinnati, O., operated by the Cincinnati Incline Plane Company.

Queen & Company, of Philadelphia, in consequence of the great demand for Ayrton & Perry's magnifying spring ammeters and voltmeters, have much increased their already large stock of these instruments, and can fill orders for all the regular ranges without delay. The cardinal points in these instruments are portability, freedom from magnets, hence they are not affected by dynamos, direct reading scales, which are at the same time proportional throughout. That the Ayrton & Perry meters are appreciated is shown from the great demand for them during the last few years. They have been and are now used very extensively on electric railroads.

OUR SAN FRANCISCO LETTER.

In describing an accident which happened to a dynamo at the California Electric Light Company's works, the other day, a bright reporter on one of our leading dailies stated that "when the armature (which was four feet in diameter) had attained a speed of about 1,000 revolutions per minute, the centrifugal force was so great that the magnets flew from the periphery at various tangents with terrific force, and that the volts (big fellows, weighing 20 pounds each) whizzed through the air with the velocity of cannon balls, and buried themselves in the walls of the establishment! One man was injured, though not seriously." Perhaps he was hit by one of the flying volts!

The Grove Street Electric Road, Oakland, Cal., is being built under a franchise granted by the council, but in opposition to the law of the State, which makes no provision for electric roads. The company is threatened with an injunction suit as soon as it reaches Eighteenth street, and if prevented from continuing the work, will suspend all operations until the next legislature changes the law.

A lineman who recently completed a tour of inspection of the telegraph wires between here and Austin, Nev., reports that in a low place where the water settles in pools through the Winter along the route, he noticed six telegraph poles that had evidently taken root, as they were covered with foliage. The poles are cottonwood and were planted with bark on them.

San Francisco, June 21. A. J.

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JUNE 24, 1890.

430,606 Magnetic power equalizer. 430,607 430,608 Electro-mechanical combination lock; William W. Alexander, Kansas City, Mo., assignor to the Gill-Alexander Electric Manufacturing Company, same place.

430,622 Electric lamp support; James Chase, Rochester, N. Y.

430,633 Electric temperature regulator; Lucien F. Easton, La Crosse, Wis.

430,634 Regulator for dynamos; William H. Elkins, Boston, Mass.

430,636 Electric circuit controlling apparatus; Edwin R. Gill, Jr., Pleasant Hill, assignor to the Gill-Alexander Manufacturing Company, Kansas City, Mo.

430,637 Automatic signal and switch controlling apparatus and verifying mechanism; Edwin R. Gill, Jr., Pleasant Hill, assignor to the Gill-Alexander Electric Manufacturing Company, same place.

430,645 Incandescent lamp hood; John Heath, Plymouth, Mass.

430,686 Switch for electric locomotives; Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place.

430,688 Commutator for induction generators for telegraph lines; Walter S. Richards, Boston, Mass., assignor of one-half to Geo. B. James, same place.

430,690 Electric railway; William Robinson, Boston, Mass.

430,696 Insulator; William H. Seamon, Rolla, Mo.

430,722 Arc lamp; James J. Wood, Brooklyn, N. Y.

430,735 Annunciator; Robert P. Garsed, Norristown, Pa.

430,747 Telephone exchange apparatus. 430,748 Telephone exchange key-board apparatus; Joseph J. O'Connell, Chicago, Ill.

430,759 Graphophone; Roswell H. St. John, Cleveland, Ohio.

430,764 Electric lock; Chas. B. Beers and Wm. B. Tuttle, Bridgeport, Conn.

430,804 Electrical calculating system; Herman Hollerith, St. Louis, Mo.

430,838 Method of electric welding or metal working; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.

430,846 Insulating joint; Emil F. Gennert, New York, N. Y.

430,865 Electrical indicator; Harry W. Leonard, New York, N. Y.

430,868 Regulation system for electric circuits; Cyprien O. Mailloux, Brooklyn, N. Y.

430,918. Telephone mouth piece and holder; Elizabeth B. Bell, Washington, D. C.

430,926 Suspending device for electric conducting wires; William M. Davis, East Weymouth, Mass.

430,932 Manufacture of incandescent lamps. 430,933 Filament for incandescent lamps. 431,018 Dynamo or magneto electric machine; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

430,934 Electric lighting system; Thos. A. Edison, Menlo Park, N. J.

430,960 Telephone system; Isidor Kitsee, Cincinnati, O., assignor by direct and mesne assignments of one-half to Jerome Carty and John A. Weidersheim, Philadelphia, Pa., and Chas. J. Kintner, New York, N. Y.

430,967 Fusible cut-out; Isaac N. Miller, Cincinnati, O.

430,974 Electric connection; Hercules Sauche, Detroit, Mich.

430,990 Galvanic battery. 430,991 Carbon for electrical purposes and the process of making it; John H. Davis, Findlay, O., assignor of one-third to Teatman Bickham, same place.

430,992 District police and fire telegraph; Chas. C. Duke, Trenton, N. J.

431,011 Electric railway signal; William J. Smith, Charlottesville, and James W. Fox, Lexington, Va., assignor of two-thirds to Asher Ayres and Geo. C. Jordan, both of Staunton, Va.

431,017 Block signaling system for railroads; Mahlon S. Conly, Hyde Park, Ill.

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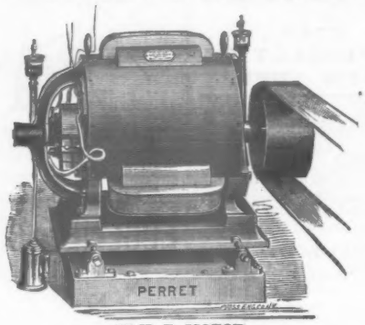

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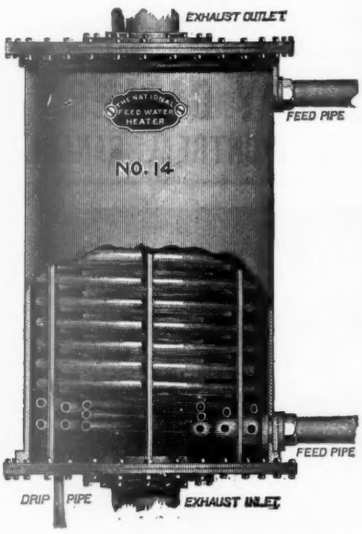

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*Electrical Accumulator Company *vs.* Julien Electric Company, 38 Federal Reporter, 117. *Brush Electric Company *vs.* Julien Electric Company, 41 Federal Reporter, 679.

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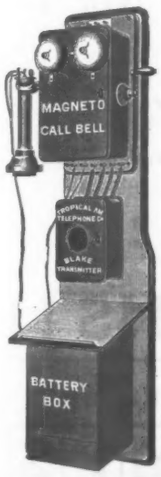

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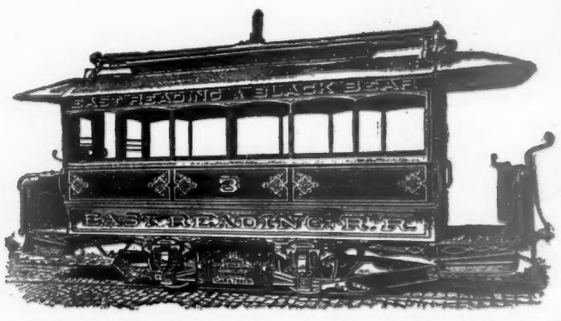

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LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	530
D	.....	10	.....	.....	6.3	1¼		530
E	.....	.....	.....	25	8.0	2		530
F	16	.....	.....	.....	12.0	2¾		780
G	.....	20	.....	.....	12.5	2¾		780
H	.....	.....	33	.....	13.0	2¾		780
I	30	.....	.....	.....	15.0	3		900
J	.....	25	.....	.....	15.6	3		900
K	.....	.....	33	.....	15.0	3		900
L	.....	.....	.....	50	16.0	3		900
M	28	.....	.....	.....	21.0	4½		1,360

Hall Electric Light Co.
18 CORTLANDT ST.
NEW YORK

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
C	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
D	.....	.....	45	.....	21.0	4		1,360
E	.....	.....	.....	70	21.0	4½		1,360
F	40	.....	.....	.....	29.7	6		1,750
G	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
J	.....	65	.....	.....	38.6	8		2,290
K	.....	.....	83	.....	38.0	8		2,290
L	64	.....	.....	.....	46.5	10		2,770
M	.....	80	.....	.....	47.1	10		2,770
N	75	.....	.....	.....	52.5	12		3,300

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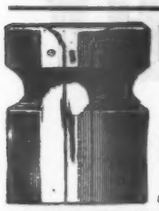

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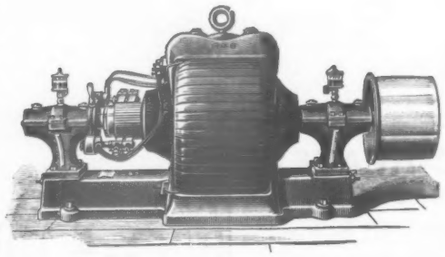

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FIG. 1.

Fig. 1 represents Copper Tee used for branching from main cables, as shown in Fig. 2.

FIG. 2.

Fig. 3 represents a Copper Sleeve used for straight connections for continuation of cables.

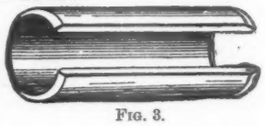

FIG. 3.

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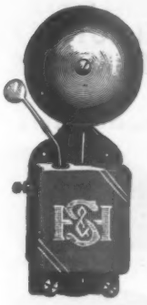

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53 KILBY ST., Room 63,
BOSTON, April 21, 1890.

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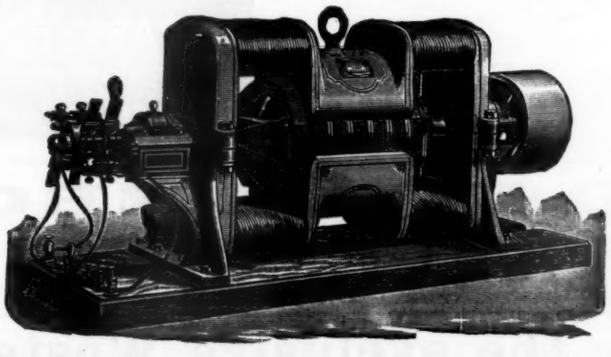

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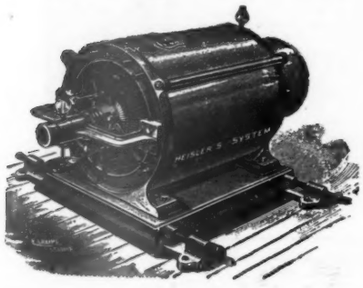

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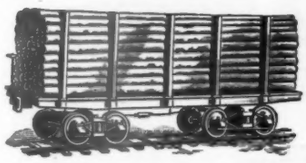

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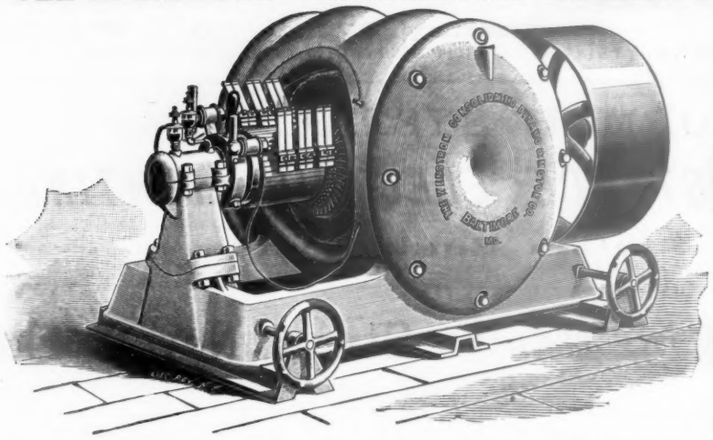

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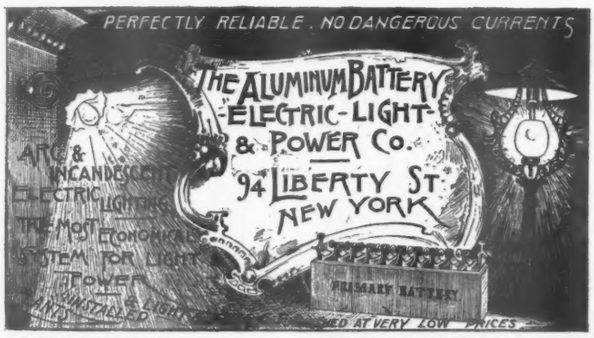

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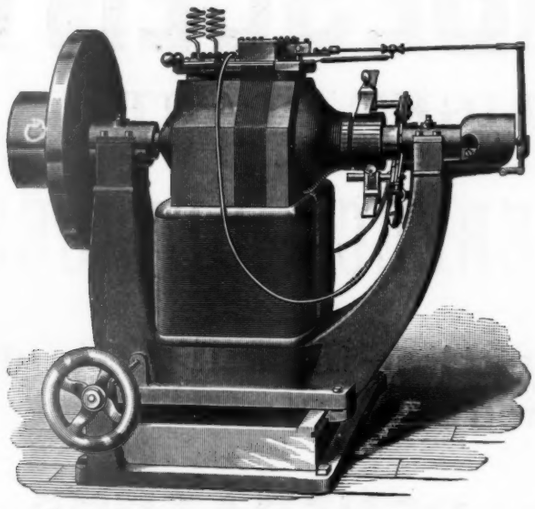

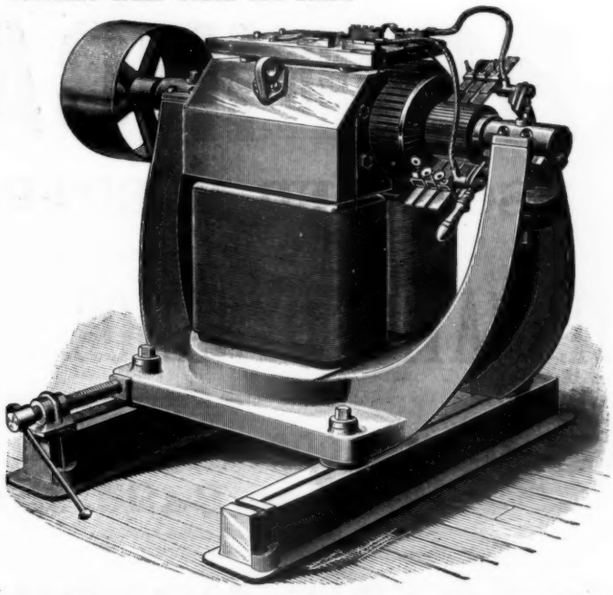

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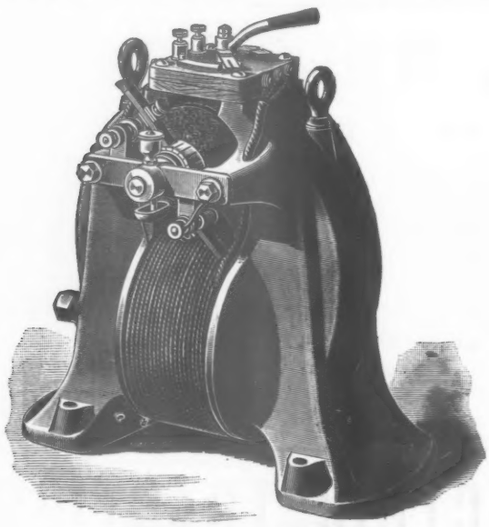

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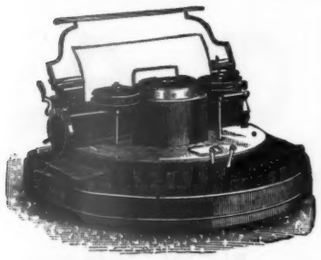

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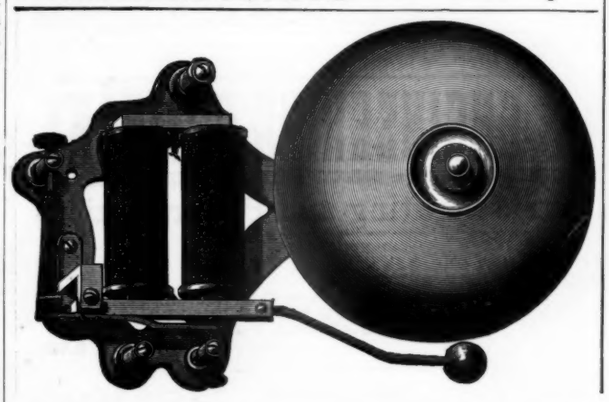

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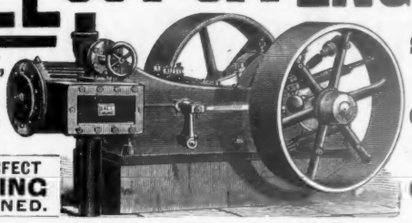

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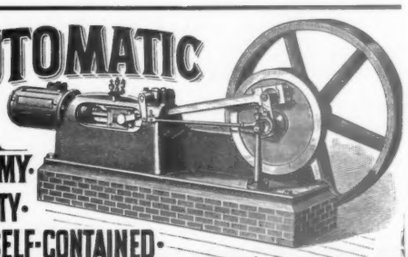

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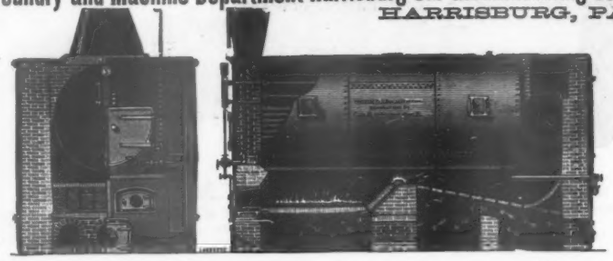

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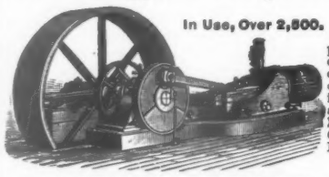

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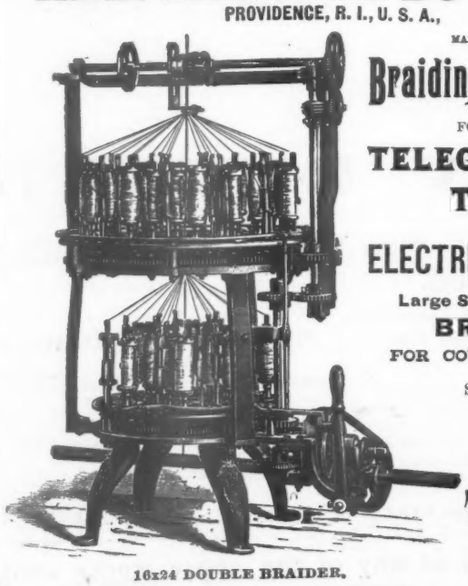

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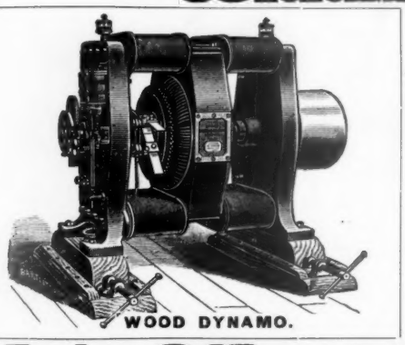

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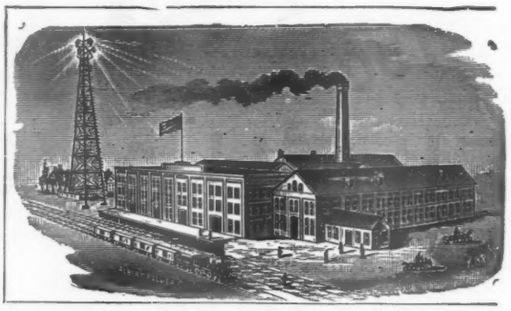

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